National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Glacier Bay National Park and Preserve Oceanographic Monitoring Protocol

Version OC-2014.1

Natural Resource Report NPS/SEAN/NRR—2014/851

ON THE COVER
An array of instruments is about to be deployed in order to record water column conditions from the surface to the bottom of Glacier Bay, as low as 400 m below sea level.
Photograph by Glacier Bay National Park and Preserve.

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This report is a technical and editorial update to an existing protocol that received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data and whose background and expertise put them on par technically and scientifically with the authors of the information.

This report is available in digital format from the Southeast Alaska Inventory and Monitoring Network (http://science.nature.nps.gov/im/units/sean/OC_Main.aspx) and the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

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NPS 132/126437, September 2014

Revisions

Southeast Alaska Network (SEAN) monitoring protocols are monolithic, with all narrative, standard operating procedures, and appendices bound into a single package. This guarantees that all the components required to consistently run a program are unambiguously defined and are not subject to intermixed methodologies caused when staff are expected to assemble instructions from multiple sources. Each package is assigned a specific formal version identifier to distinguish its content from earlier work. The identifier for oceanographic monitoring is in the form OC-YYYY.v, where YYYY is the year the majority of writing occurred and v is a sequence number used to distinguish a protocol if more than one version is published in a year.

The version identifier is stamped on every product created under a protocol, including the individual rows in databases. It is common for database objects to contain values acquired under multiple protocol versions. Users should be aware that records within the same table may reflect somewhat different definitions or methodologies, but these are precisely documented in the protocol package that corresponds to the protocol identifier in each row.

This protocol package is designated version OC-2014.1.

Revision History Log:

Base Version	Publication Date	Authors	Changes Made	New Version ID
OC-2010.1	August 2014	W. Johnson, L. Sharman	Revise workflows to incorporate new Data Steward role. Make extensive updates/corrections to process details. Reflect latest website and information architecture. Specify methods for providing backup instrumentation. Support Sea-Bird .XMLCON format calibration files. Replace DFS file referencing with DNS-based names. Insert safety appendix. Employ revised nephelometer algorithm. Include more recent citations. Document processing software detailed configurations. Remove unimplemented deliverable OC_E (AOOS). Remove obsolete reference to 2009 working group.	OC-2014.1
[none]	October 2010	S. Danielson, W. Johnson, L. Sharman, G. Eckert, B. Moynahan	Initial version	OC-2010.1

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Abstract

Initiated in 1993, the Glacier Bay hydrographic survey archives represent one of the longest-running oceanographic datasets in Alaska waters. This updated document—the first formal protocol revision since the initial (2010) version—describes the field methods and data handling procedures required to ensure an uninterrupted and consistent sampling program exhibiting solid collection, quality assurance, archiving, and dissemination procedures. The products generated will enable future analyses to better interpret observed changes in the marine physical environment and better understand how they impact the abundant marine life found within Glacier Bay.

Nine field surveys are scheduled for each year: comprehensive surveys in midwinter and midsummer with occupation of all 22 standard stations, and seven monthly surveys between March and October with occupations of eight representative core stations. Water column profiles of the following parameters constitute the measurements for all surveys: water temperature, salinity, photosynthetically active radiation (PAR), optical backscatterance (OBS—turbidity), dissolved oxygen (DO) concentration, and chlorophyll-a fluorescence.

The outcome of this program consists of data and information products. Their specific content and detailed methods for building them are rigorously defined.

Acknowledgments

The authors extend their deepest appreciation to all the people who have been responsible for conducting Glacier Bay oceanographic surveys over the past two decades and more. Oceanographic time series of this extent and quality are rare anywhere and particularly rare in Alaskan waters. The science field crews, vessel operators, and principal investigators all have dedicated significant time and resources toward creating this dataset and these efforts have resulted in what will be an enduring legacy through the implementation of this oceanographic monitoring program. We thank Hooge et al. (2003) for providing a sound foundation for the subsequent generation of this protocol. Additionally, we thank S. Danielson, G. Eckert, and B. Moynahan who collaborated with us in developing the initial version of this protocol (Danielson et al. 2010), and the reviewers of that first version who provided valuable and defining input to the process. In particular, L. Etherington, M. Arimitsu, D. Hill, D. Tucker, T. Royer, and T. Weingartner all contributed helpful insights and comments. We are also grateful to C. Sergeant for his helpful suggestions regarding this document’s content.

1.0 Background and Objectives

1.1 Protocol Provenance

This protocol has its roots in both Hooge et al.'s *Fjord Oceanography Handbook* (2003) and Danielson et al.'s *Glacier Bay National Park and Preserve Oceanographic Monitoring Protocol Version OC-2010.1* (2010). The National Park Service (NPS) Southeast Alaska Network (SEAN) and Glacier Bay National Park and Preserve (GLBA) resource management staff created this document as a revision to the OC-2010.1 protocol, following the formal process defined in SOP 18 of that protocol for performing a "minor" revision. A minor revision is one that updates detailed processes and definitions but does not alter the purpose, objectives, or survey design of the monitoring program.

The protocol narrative provides an overall description of tasks, processes, and staff responsibilities for conducting the monitoring program. Standard operating procedures (SOPs) provide detailed, step-wise instructions for conducting each process. SOPs are referenced in each narrative section, as appropriate. The narrative, appendices, and SOPs comprising this protocol form a single self-consistent unit. They are not intended to be used piecemeal or merged with documents from other versions, or conflicts at the detail level may result.

This protocol was designed for use in Glacier Bay proper. Throughout this document, we use "GLBA" to refer to the entirety of the NPS administrative unit of Glacier Bay National Park and Preserve, and "Glacier Bay" to refer to Glacier Bay proper.

Much of Section 1.2 is reproduced from the executive summary of Eckert et al. (2006), *Assessment of Coastal Water Resources and Watershed Conditions at Glacier Bay National Park and Preserve, Alaska.* Readers are encouraged to consult the documents cited in Section 1.2 for additional references and more detailed background information.

1.2 Historical and Biophysical Background

Glacier Bay has been used by Alaska Native peoples for centuries (Schroeder 1995), including use by ancestors of the modern Tlingit. European and Russian explorers and hunters "discovered" Glacier Bay in the 18th and 19th centuries, culminating with John Muir's visit with the Harriman Alaska Expedition in 1899 (Goetzmann and Sloan 1982). Following the suggestion of William S. Cooper and with the backing of the Ecological Society of America, on February 26, 1925, President Calvin Coolidge created Glacier Bay National Monument to preserve the majestic beauty and scientific opportunities. The area of the monument doubled in size in 1936, and the boundaries were modified in 1955, excluding Gustavus and the east side of Excursion Inlet. Gold mining was permitted from 1936 until 1976. Glacier Bay became a national park through the Alaska National Interest Lands Conservation Act (ANILCA) of 1980, which extended the park boundary to the Alsek River and Dry Bay for a total area of over 1.33 million ha (3.28 million acres), including 23,426 ha (57,884 acre) in the preserve (Eckert et al. 2006). GLBA was designated an International Biosphere Reserve in 1986 and a World Heritage Site in 1992. In a 2005 U.S. Supreme Court case filed by the State of Alaska, the NPS was granted jurisdiction over submerged lands and tidelands within GLBA boundaries. This decision made GLBA one of the few protected areas in the world that includes submerged marine habitat within its jurisdiction. Bartlett Cove is the single major site of terrestrial human presence in GLBA and the only location in the park that is human-occupied year-round.

GLBA is located in Southeast Alaska and is bordered by the Gulf of Alaska to the west, Icy Strait to the south, Tongass National Forest to the west and northwest, Tatshenshini-Alsek Provincial Park (Canada) to the north, and Tongass National Forest to the northeast (Figures 1.1 and 1.2). GLBA encompasses marine areas along the outer coast, Cross Sound, Icy Strait, Glacier Bay proper, and smaller bays including Dundas Bay, Lituya Bay, Torch Bay, and Dry Bay.

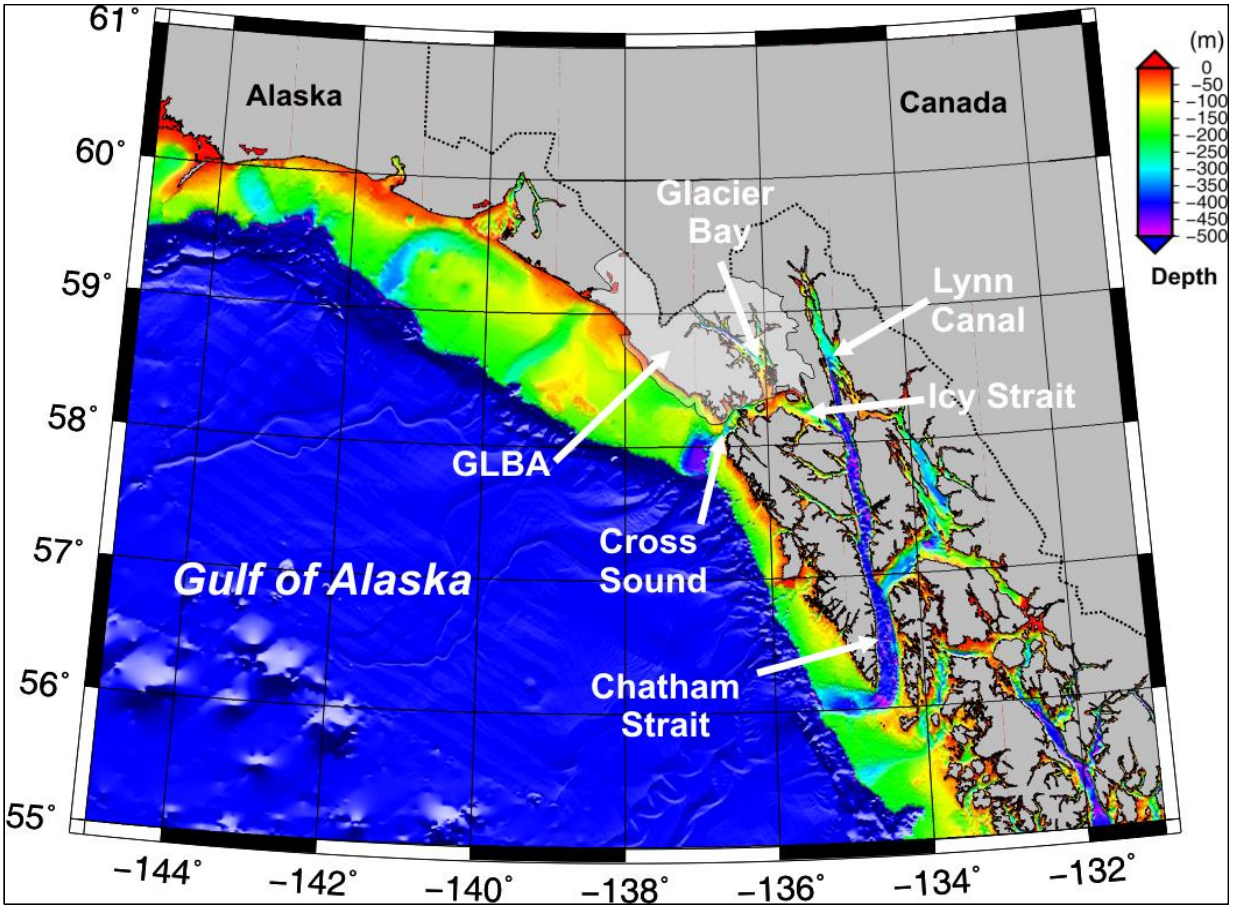

Figure 1.1. Map of the northeastern Gulf of Alaska showing Glacier Bay and GLBA (light shading) with respect to the nearby major bodies of water. Color shading represents the bathymetric topography, with depths of greater than 500 m colored dark blue. The entrance to Glacier Bay resides at the crest of a shallow sill (~50 m) in Icy Strait, separating northern Chatham Strait from Cross Sound.

GLBA is well known as a natural laboratory, and studies of ecological succession began in the late 1800s and early 1900s with John Muir and William S. Cooper. Vegetation changes along the chronosequence gradient of glacier recession within Glacier Bay are classic examples of ecological succession (Cooper 1923, Lawrence 1958). Follow-on studies in other ecosystems have continued this theme of physical and biological community development following in the wake of glacial retreat (Milner 1987, Sharman 1989, Fastie 1995, Engstrom and Fritz 2006, Milner et al. 2007). Beyond studies primarily concerned with succession, GLBA has hosted a wide variety of research efforts across a multitude of scientific disciplines (Wood et al. 1984, Milner and Wood 1989, Engstrom 1995, Piatt and Gende 2007).

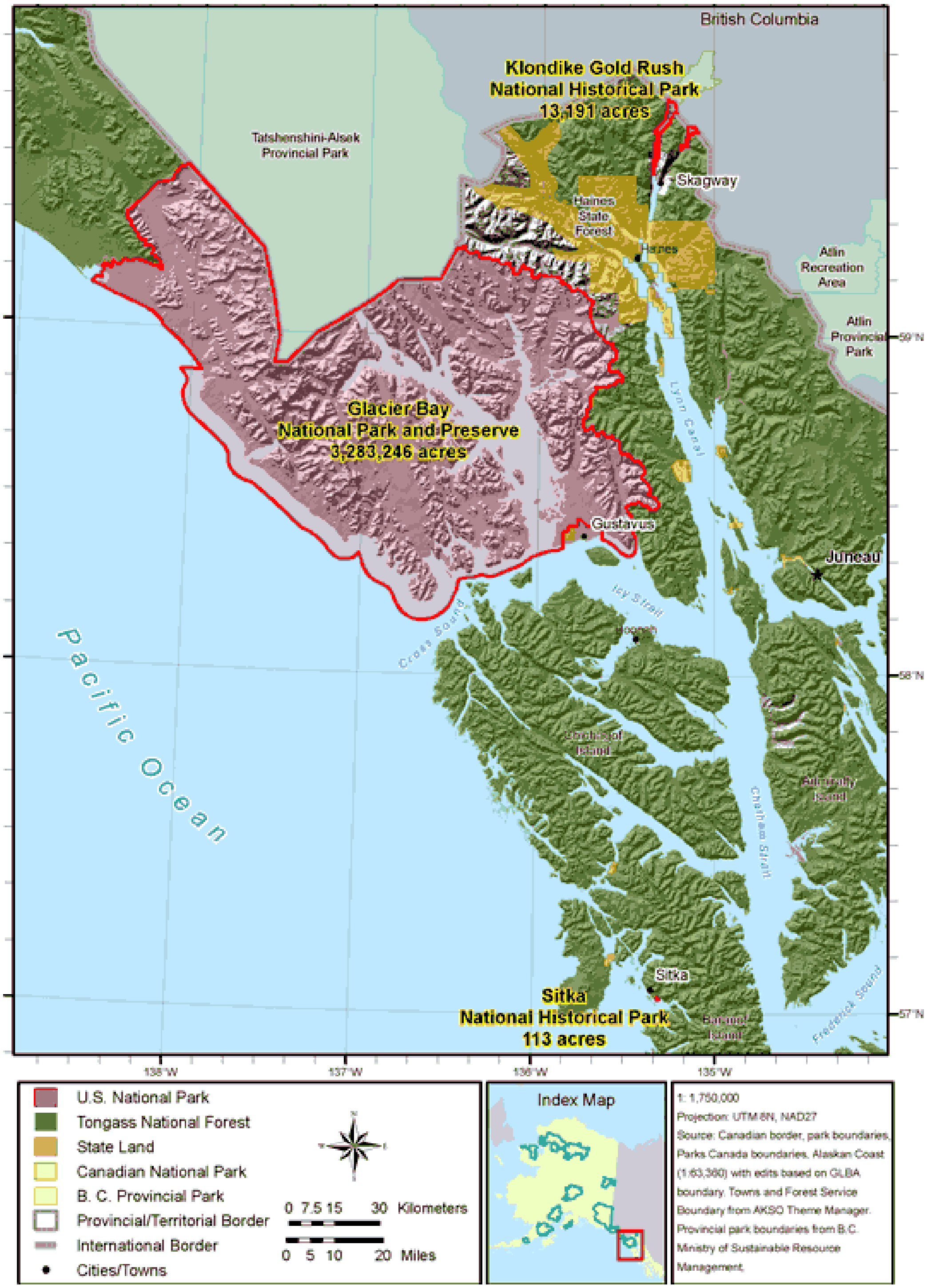

Figure 1.2. Location of GLBA with respect to nearby federal, state, and provincial parks and forests.

Glaciers have been carving the region for millions of years, and in 2010 approximately 48% (6,430 km^2) of GLBA is covered by glacial ice (Arendt et al. 2012). In 1794, Captain George Vancouver documented that Glacier Bay was only five miles long due to a massive glacier occupying the bay with its terminus located just south of Sitakaday Narrows. At that time, this large glacier, which is now called the Grand Pacific Glacier, measured more than 1,200 m (4,000 ft) thick, 32 km (20 mi) wide, and more than 161 km (100 mi) long. By 1916, the Grand Pacific Glacier had retreated 100 km (60 mi) to the present Tarr Inlet. This dramatic glacial retreat provides an outstanding opportunity to study ecological succession, the effects of climate change, and other physical and biological dynamics of the area. Glacial retreat has caused and is continuing to cause tremendous physical changes to GLBA, and as a result its freshwater and marine ecosystems are highly dynamic and challenging to understand.

The fall, winter, and spring months are dominated by the strong Aleutian Low in the northeastern Gulf of Alaska; weak high pressure systems prevail in the summer (Brower et al. 1988). As a result, GLBA experiences a wet and moderate marine climate. Records from the Bartlett Cove weather station (the oldest permanent station located within GLBA) go back to 1966 and show an average temperature of 4.9 ºC (40.9 ºF), average rainfall of 92 cm (36 in), and average snowfall of 132 cm (52 in). July is the warmest month, with an average temperature of 12.8 ºC (55 ºF), and the coolest conditions occur in January, when the average temperature is −2.8 ºC (27 ºF). Given the geographic and topographic heterogeneity across the park and preserve, however, data from this single weather station does not represent the diversity of conditions within GLBA.

Biological marine resources include a rich diversity and high abundance of marine mammals, including humpback whales (*Megaptera novaeangliae*), harbor porpoise (*Phocoena phocoena*), killer whales (*Orcinus orca*), minke whales (*Balaenoptera acutorostrata*), and rarely Dall's porpoises (*Phocoenoides dalli*), along with Steller sea lions (*Eumetopias jubatus*), harbor seals (*Phoca vitulina*), and sea otters (*Enhydra lutris*). Humpback whale monitoring in Glacier Bay proper, begun in the mid-1980s, indicates a population that is increasing 4.4% annually from 1985 through 2009 (Saracco et al. 2013). Harbor seals, however, have undergone a drastic decline of over 75% since 1992, at an average annual rate of approximately 10% (Womble et al. 2010). Sea otters have undergone a dramatic increase since they began recolonizing Glacier Bay in 1993, with an estimated population size of approximately 8,500 individuals in 2012, representing an annual growth rate of 42% (Esslinger et al. 2013).

Fish and bird diversity in GLBA are very high. Glacier Bay is an important nursery area for fishes and is probably a spawning location for many species. Glacier Bay provides important habitat for many marine birds, with species composition shifting from predominantly seabirds in the summer to predominantly waterfowl in the winter. Glacier Bay supports the largest breeding-season population of Kittlitz's murrelets in the world, with annual surveys from 2009 through 2013 estimating 7,000 to 16,000 individuals (Hoekman et al. 2014). Marine invertebrate resources are diverse and abundant and include Tanner (*Chionoecetes bairdi*), Dungeness (*Cancer magister*), and king crabs (*Paralithodes* spp.).

1.3 Purpose of Oceanographic Sampling

Oceanographic measurements collected during surveys enable a set of first-order perspectives into local ecosystem relationships (Mann and Lazier 1996). Physical measurements at 1-m resolution include temperature, salinity, penetration of photosynthetically active radiation, turbidity, chlorophyll-*a* fluorescence, and dissolved oxygen concentration. These measurements characterize the environment that directly impacts both lower trophic (e.g., phytoplankton) and upper trophic (e.g., crabs, fishes, marine mammals, and birds) organisms through their influence on metabolic rates, ability to support carbon fixation through production of chlorophyll, and the propensity for organisms to be retained within or exported from the euphotic layer. Fluorescence measurements provide an index of the phytoplankton standing stock, which in turn forms the food base for primary consumers (zooplankton) and transmits carbon through trophic levels to apex predators (e.g., fishes, marine mammals, and birds). Thus, observations made by this monitoring program form a foundation upon which other aspects of the marine ecosystem (e.g., chemical hydrography, habitats, animal populations) within Glacier Bay can be evaluated. Because this dataset comprises one of the longest-running oceanographic time series in coastal Alaska waters, it also provides a valuable perspective of the regional oceanography: similar-length datasets of comparable quality and measured parameters are found only hundreds of kilometers up- and down-coast.

1.4 Overview of Previous Oceanographic Sampling

Multiple sills, embayments, tidewater glaciers, islands, and other topographic features characterize Glacier Bay’s complex bathymetry. Previous oceanographic studies focusing on Glacier Bay are limited in number; most of our understanding comes from Matthews and Quinlan (1975), Matthews (1981), Hooge and Hooge (2002), Etherington et al. (2004), Madison and Etherington (2005), Etherington et al. (2007), and Hill et al. (2009).

Bottom water renewal can occur in any month (Matthews 1981, Hooge and Hooge 2002) while solar heating, snow melt, and ice melt stratify the upper water column between spring and summer (Matthews 1981, Etherington et al. 2007). The strength and relative importance of tidal mixing varies throughout the bay (Matthews 1981, Etherington et al. 2007); Glacier Bay has mixed semidiurnal tides and a large tidal range, averaging from 3.7 m (12 ft) near the mouth to greater than 4.2 m (14 ft) at the heads of the fjord arms. In 2008, the National Oceanic and Atmospheric Administration (NOAA) National Ocean Service (NOS) Center for Operational Oceanographic Products and Services (CO-OPS) deployed 51 current meters in Southeast Alaska, nine of which were within GLBA waters. The resulting data have not been published, but a project report documents average current speeds at each mooring site (Burke 2008). Results indicate that near-surface currents are highly variable depending upon location and can attain speeds as high as 220 cm/s (7.2 ft/s; Burke 2008).

Thirteen cruises collected oceanographic data between 1964 and 1967 (Matthews and Quinlan 1975, Matthews 1981), but after this time cruises were not common until 1993. Between 1993 and 2008, the NPS and the U.S. Geological Survey (USGS) conducted conductivity-temperature-depth (CTD) monitoring of physical parameters (with depth), including temperature, salinity, turbidity, photosynthetically active radiation (PAR), and in situ fluorometric measurements at 24 stations distributed throughout Glacier Bay proper. The current monitoring program began in 2009 and includes the addition of the dissolved oxygen concentration parameter, reduction of the number of stations occupied (twice yearly) from 24 to 22, and the identification of a subset of nine core stations occupied monthly. Annual reports, peer reviewed publications, program evaluations, and complete data are currently archived at the SEAN oceanography webpage (http://science.nature.nps.gov/im/units/sean/OC_main.aspx), the NPS Data Store (http://irma.nps.gov/App/Reference/Search/299), and the National Oceanographic Data Center (http://www.nodc.noaa.gov/cgi-bin/OAS/prd/accession/details/74611).

This oceanographic monitoring program has documented salinity values ranging from less than 10 to greater than 32 practical salinity units (PSUs), with the least saline waters found in narrow surface lenses near tidewater glaciers and the most saline waters at depth in the lower bay. Density fluctuations are primarily driven by salinity, which is the principal determining parameter for density in most coastal Alaska waters. Seawater temperatures range from 1 to 15 ºC (33 to 59 ºF), with the coldest temperatures found at the heads of the two arms in late winter and the warmest waters observed in surface stratified waters during summer. Light penetration is reduced by sedimentation resulting from glacial runoff and by increases in phytoplankton biomass. The factors driving reductions in light penetration are important to understand because the amount of light available impacts phytoplankton production. Zooplankton surveys indicate rich productivity in a variety of locations within Glacier Bay, particularly in near-surface waters in upper inlets (Robards et al. 2003).

1.5 Rationale for Selecting This Resource to Monitor

GLBA is quintessentially a marine park. Along with weather, glaciers, and landforms, the ocean waters drive the park’s ecosystems and strongly influence the dynamics of many biological communities, from primary producers to apex predators. A number of the SEAN Vital Signs applicable to GLBA (e.g., Marine Contaminants, Kittlitz’s Murrelets) are directly or indirectly influenced by oceanography. By monitoring select parameters, managers can detect oceanographic changes that are likely to influence the condition of many resources throughout the park and region. Oceanographic monitoring is important to understanding the Southeast Alaska regional marine ecosystem, the linkages between atmospheric and oceanic systems, and the implications of climate change in high-latitude systems.

Standard oceanographic data are universally recognized among marine scientists as essential to understanding how ocean waters influence marine communities in a “bottom-up” fashion (McLeod and Leslie 2009). The cascade of energy to higher trophic levels begins with the water column conditions (e.g., temperature, stability) that are included in the data collected by this program. Along with water column stability and nutrient availability, the availability of light drives primary productivity, which then controls the dynamics of secondary productivity and indeed the entire marine trophic web. Light and light limitations in water high in suspended sediment have been identified as critical factors impacting phytoplankton production within Glacier Bay (Hooge and Hooge 2002).

Petroleum spills present a particularly high-consequence environmental risk to coastal water resources in GLBA. Geographic response strategies (GRSs) are area-specific spill response plans intended to protect especially sensitive areas from spill impacts. Within Glacier Bay there are GRSs for Point Carolus, Bartlett Cove, Berg Bay, Hugh Miller Inlet, North Beardslee Islands, South Marble Island, and Sandy Cove. In 2007 SEAN initiated a marine contaminants monitoring program (using intertidal mussel tissue assays) to track long-term trends and to maintain a moving baseline that would be exceptionally valuable in the event of an acute local impact (e.g., a spill resulting from a vessel grounding).

Recent analyses suggest that climate change is an important natural resource issue for national parks that may dramatically impact water resources (http://www.nps.gov/akso/nature/AKCCRS.pdf). Climate change impacts the extent of permafrost and glaciers and the timing of annual sea ice onset and retreat. A direct result of increased glacial melt is an increase in coastal runoff (Arendt et al. 2012) and an alteration of coastal sediment discharge. Both inputs can have downstream consequences for marine ecosystems. Possible effects include increased levels of stratification (with implications for phytoplankton growth timing and magnitude) and increased cross-frontal density gradients (with implications for along-shore transport and cross-frontal mixing processes). Reports from the Intergovernmental Panel on Climate Change (e.g., IPCC 2013) predict high probabilities of increased mean global temperatures over the coming decades. The cryosphere is known to be particularly sensitive to fluctuations in temperature; many icefields in Alaska are now experiencing net ablation and many tidewater glaciers are retreating. Currently, glaciers in coastal GLBA are thinning at rates as fast as 4 m (13 ft) per year, and glacial retreat over the last two centuries has moved the leading edge of the tidewater glaciers in Glacier Bay up the fjord more than 100 km. The isostatic rebound associated with retreating ice (Larsen et al. 2004) can strongly impact the ecosystem near the water's edge (both on land and in the water). Glacial systems are dynamic balances between accumulation and ablation; continued glacial retreat as well as any future periods of glacial advance will modify both the terrestrial and marine environments and ecosystems. Monitoring the accompanying oceanographic changes is critical to understanding the causes and implications of such changes.

Eckert et al. (2006) identified four factors that could contribute to impairment of GLBA marine water resources: contaminants, harmful algal blooms, invasive aquatic species, and climate change. Biological populations will respond to impacts realized, and the oceanographic monitoring program enables us to better understand and/or mitigate resultant changes and effects. Within GLBA, nearly all other resource and research issues are related to the marine ecosystem. Therefore, a better understanding of the many interconnected subsystems is greatly improved by increased knowledge of underlying oceanographic processes.

1.6 Measurable Objectives

The adopted objectives for the GLBA oceanographic monitoring program were refined through discussion during the 2006 program evaluation (Etherington 2006) and are reworded here for clarity:

> The purpose of this sampling is to compile a dataset of oceanographic conditions from Glacier Bay that can be used 1) to better understand seasonal and inter-annual changes in the local and regional oceanographic dynamics, and 2) to better understand spatial and temporal variation in the abundance patterns of marine organisms including phytoplankton, zooplankton, marine invertebrates, fishes, mammals, and seabirds. Measured and derived parameters that comprise this dataset include temperature, salinity, stratification,

photosynthetically active radiation (PAR), optical backscatterance (OBS; turbidity), chlorophyll fluorescence, and dissolved oxygen concentration.

2.0 Sampling Design

Between 1993 and 2008, oceanographic sampling occurred at up to 24 stations approximately quarterly. In designing the sampling scheme initially implemented in 2009, we worked to incorporate results from prior monitoring program reviews, evaluations of our proposed modifications, and relevant peer-reviewed publications that employed earlier data. The current program maintains coherence with past sampling while forming the basis for the strongest possible sampling program from that point forward. We adopted the 10-year to 100-year view: by 2020 the dataset will span over a quarter century, and the bulk of observations will still be from collections made prior to 2009. In 100 years, however, collections made prior to 2009 will comprise fewer than 15% of the total observations. To gain maximum utility, we strove for a balance between continuity with samples taken before and after 2009 and what we believed to be the most useful dataset in the long run.

We were fortunate to have this considerable dataset and several corresponding analyses to inform our development of a long-term protocol. Analyses of existing data revealed that past quarterly sampling adequately resolved interannual signals but needed more resolution to permit characterization of seasonal signals. Achieving both scales of resolution are inherent to meeting our monitoring objectives.

This SEAN protocol, therefore, modifies the sampling design to achieve a balance between spatial and temporal resolution: semiannual sampling at the full complement of 22 stations and monthly sampling from March to October at a subset of eight core stations. Samples are taken in the months of March, April, May, June, July, August, September, and October and once in midwinter (December or January). Station locations are shown in Figure 2.1.

Water column CTD profiles include direct measurements of pressure, temperature, conductivity, fluorescence, dissolved oxygen concentration, PAR, and OBS. Derived values from these measurements include depth, salinity, density, and chlorophyll-*a* concentration.

2.1 Rationale for Selecting This Sampling Design Over Others

The selected sampling design achieves moderate spatial resolution of the selected parameters at the full complement of 22 stations (Figure 2.1) so that annual and longer timescale signals can be resolved at nearly all historical CTD stations. Also, monthly sampling (but with coarser spatial resolution) is conducted at the eight core stations across the spring, summer, and fall when the water column physical properties exhibit their strongest temporal and spatial gradients. The greatest range in densities occurs from the spring (cold and salty) to fall (warm and fresh). This design achieves a balance between intensive spatial sampling two times per year (once midwinter, once midsummer) to resolve annual signals and an intensive temporal sampling at a smaller suite of stations to resolve seasonal signals during the time that heat and fresh water accumulate in the system. This spatial/temporal balance addresses logistical, weather, budget, and logistical realities associated with limited numbers of ship days, labor, and funds that can be reliably sustained by the NPS over the long term.

Figure 2.1. Oceanographic sampling station locations in Glacier Bay, Alaska. Stations making up the core station set are shown on a blue square background. Stations 00–14, 16–21, and 24 make up the full station set. Stations 00–23 were historically sampled. Sampling of stations 15, 22, and 23 was discontinued in 2009.

The protocol calls for three days of ship time twice yearly for the “all stations” cruises in July and midwinter, and two days each for the monthly core station cruises March through June and August through October. This reduction (from the pre-2009 protocol) in the number of days necessary to complete most cruises requires a shorter window of favorable weather to complete the minimum sampling and will result in a more complete dataset. Careful planning allows for many of the monthly sampling field trips to be achieved in a single extended day of fieldwork, thereby reducing the total number of ship days per year.

In addition to the selected design, three alternative designs were considered. The following subsections (2.1.1 through 2.1.3) present brief summaries of these alternative designs.

2.1.1 Alternative Design 1: Quarterly Sampling at Historical Station Locations

Alternative design 1 represented a continuation of monitoring at the 24 pre-2009 stations on a quarterly basis. Although this option would maintain the highest degree of continuity between historical and future efforts, this design was not attractive because it would not adequately resolve seasonal signals and thus would not fulfill the program objectives stated in Section 1.3.

2.1.2 Alternative Design 2: Oceanographic Moorings

We considered subsurface taut-wire oceanographic moorings in alternative design 2. Advantages of a monitoring program built upon mooring technology include high-frequency temporal sampling (~1 hour, year-round) and the need of only one ship day per year for mooring servicing. Disadvantages include potential loss of an entire year’s worth of data should the mooring catastrophically fail; inability to reliably sample the uppermost 10 m of the water column, where many important physical and biological processes take place; problems associated with biofouling, which can degrade measurement accuracy; and the considerable initial cost to purchase all needed equipment (estimated at $50,000 to $100,000 per mooring, depending on configuration). The single most important disadvantage is that a mooring system would yield lower-resolution spatial sampling (both in the horizontal and vertical dimensions), precluding achievement of our monitoring objectives. For these reasons, we determined that this alternative was not an acceptable replacement for the existing monitoring program. A mooring would be a very useful addition to provide a high-frequency temporal sampling component, if new funds become available.

2.1.3 Alternative Design 3: Incorporation of Ocean Acidification Measurements

Due to the recognized risk of ocean acidification to marine ecosystems, we also considered monitoring the carbonate cycle as part of the hydrographic cruises. A number of factors make this, as a sustained effort, unrealistic at the present time. Primary among them is that to measure oceanic pH, the commercially available pH probes for deployment with a CTD do not achieve the required resolution; they achieve an accuracy of about 0.1, whereas an accuracy of 0.002 is desired in studying ocean acidification (North Pacific Marine Science Organization 2007). To achieve the required accuracy, water column samples must be obtained and processed in an analytical laboratory. For the purposes of this monitoring program, the costs and additional effort are impractical; however, SEAN and GLBA worked to identify external funding sources and partnerships that would allow us to add this important component to our selected design. A standalone project aimed solely at defining the current condition of Glacier Bay with regard to ocean acidification was conducted by the

University of Alaska Fairbanks' Ocean Acidification Research Center, with support by the NPS, from 2011 to 2014.

2.2 Site Selection

The full station set includes stations 00–14, 16–21, and 24; see Figure 2.1 for a map of station locations and the grouping of stations into the four primary spatial domains. Appendix A provides geographic coordinates of the stations. Station 24 (North Passage) was added in response to recommendations of the 2006 Program Evaluation Report (Etherington 2006) and comments made by reviewers of the 2009 protocol, including the desire to sample Glacier Bay's source water. Specifically, the 2006 Program Evaluation Report identified the most important candidate for an additional station as "west of the bay mouth in deeper water NW of Lemesuier Island" (Etherington 2006). The location for station 24 was chosen to coincide with the deepest point in the passage cross-section and within a reasonable distance of the mouth to Glacier Bay so that vessel transit time to the station is practical. The full station set comprises the majority of the historically sampled CTD stations from the years 1993 through 2008. Stations 22 and 23 in Geikie Inlet were not included within this program because Etherington (2006) recommended their elimination to reduce the time required to attain all samples. Station 15 was sampled historically but was dropped from the program in 2005 after confirmation of a high degree of redundancy with station 14.

The core station set includes stations 01, 04, 07, 12, 13, 16, 20, and 24 (Figure 2.1). These stations were chosen to achieve two representative samples in each of the primary oceanographic domains at a higher temporal sample rate during the spring, summer, and fall months.

Previously published annual reports, peer-reviewed journal articles, and program reviews form the basis for the selection of the core and full station sets. The core stations are selected to capture samples in each of four oceanographic domains within Glacier Bay. These domains (Lower Bay, Central Bay, West Arm, and East Arm) reflect different—though not independent—biophysical settings that give each domain its own characteristics. These domains are not exhaustive of all possible marine settings within Glacier Bay, but they do represent a wide variety of habitat types. Etherington et al. (2007) address the breakout of stations and show that variability within domains is generally small compared to variability across domains.

Station 12 (rather than 21) was selected for inclusion within the core station set because the historical database contains more occupations of station 12 and, in months of thick ice cover, station 12 is more accessible. Stations 12 and 20 add considerable time to the fieldwork due to the long transits required to access the stations but, due to the proximity of these stations to the fjord heads, they are situated within habitat types not found farther down the fjords. These stations are important to help keep attention upon the shallow buoyant ice melt/coastal runoff plume observed at the head of each fjord and the associated biological responses (e.g., Kittlitz's murrelet habitat and those documented in Etherington et al. [2007]).

2.3 Sampling Frequency and Replication

Sampling includes vertical CTD profiles at

- the full station set twice per year: summer (July) and winter (December or January)
- the core station set in March, April, May, June, August, September, and October

One vertical profile is required at each of the sample sites. The CTD samples at a rate of two measurements per second. These raw scans are subsequently averaged into 1 m bins. At a typical lowering rate of 1 m/s, this achieves approximately two samples per 1 m average depth level in the final data file. This final data product thus achieves a medium-resolution depiction of all variables throughout the measured water column.

2.4 Level of Change Detectable for the Amount and Type of Sampling Being Instituted

Monthly sampling of the core station set between March and October allows resolution of seasonal variability during the periods that exhibit the greatest biological production and the physical system is typically undergoing its most rapid thermal and freshwater fluctuations.

Semiannual sampling of the full station dataset achieves a higher resolution depiction on an annual basis at the highest feasible spatial resolution. This dataset will be appropriate for evaluating interannual variability associated with climate-scale processes such as the El Nino Southern Oscillation (ENSO) cycle, the Pacific Decadal Oscillation (PDO), or the North Pacific Index (NPI).

The sample design does not resolve nearshore oceanographic properties or submonthly time scales. Tidal fluctuations are regular and predictable, however, and measurements can be interpreted with respect to the tidal phase and amplitude of the major constituents.

3.0 Hydrographic Survey

Data collected during the field survey directly contribute to the generation of annual (SOP 14) and five-year reports (SOP 15). Entries made in the "Comments" and "Notes" sections on the CTD station field log sheets help the project leader assemble the cruise operations summary for the reports. Selected photographs of unusual (or even typical) events and conditions can also be incorporated into the reports.

3.1 Field Season Preparations and Equipment Setup

Instrumentation at the start of the sampling year (December/January cruise) should be in good working order and calibrated by the manufacturer recently enough so that sensors exhibit no significant drift (less than two years prior to use). A test cast off the dock in Bartlett Cove and subsequent data download and inspection ensures proper equipment functionality and setup before heading out to the sampling stations. Instructions for assembling equipment required for the survey are given in SOP 4, Section 1, with the following subsections:

1. Field Preparations
   - Supplies to have available (see also Appendix C)
   - Check computer to CTD communications
   - Check battery voltage
   - Check memory and clear
   - Check date and time
   - Verify Vessel is Prepared
   - Soak the Dry Conductivity Cell
   - Confirm System Operability with the First Cast

3.2 Field Operations

Each survey is scheduled to occur within the first full week of the designated month (see Chapter 6.1 for exceptions). Vessel availability, vessel operator availability, and weather forecasts will all influence the actual timing of each cruise.

Details of the at-sea portion of the sampling program and the order of operations are listed in SOP 4, Section 2:

2. Field Operations
   - Select sampling sequence
   - Navigate to station
   - Complete CTD station log
   - Prepare the CTD
   - Initiate data logging
   - Equilibrate the CTD just below the surface
   - Lower CTD to target depth
   - Haul CTD back to surface
   - Terminate data logging

- Complete CTD station log
- Freshwater rinse
- Stow CTD for transit
- Download CTD data to laptop

3.3 Postcruise Operations

Postcruise operations are detailed in SOP 4, Section 3:

3.0 Postcruise Operations

- Store the CTD and associated hardware
- Transfer data to network
- Hex plot cruise data to verify quality

Complete instructions detailing file download from the CTD are found in SOP 5.

Once the data have been archived on the network servers, initial data verification steps are taken to ensure proper operation of the instrumentation and capture of data. Instructions for file verification and plotting, done to ensure proper operation of the instrumentation and capture of data, are in SOP 7.

Evaluation of postseason calibration results (SOP 9) and creation of data deliverables (SOPs 2, 3, 6, 8, 10, 11, 12, 13, and 17), including annual report generation (SOP 14), are performed using data from all cruises at the end of the cruise year after postseason calibrations have been received and evaluated.

4.0 Data Handling, Analysis, and Reporting

This chapter describes the general approaches to generating, maintaining, and disseminating the ultimate products of this monitoring protocol. Detailed procedures are provided in product-specific SOPs. Detailed product definitions may be found in Appendix J.

4.1 Overview of Information Architecture

Data in the oceanography program are managed according to the standard methods used by all SEAN programs, as described in the SEAN Data Management Plan (Johnson and Moynahan 2008). The model from which these methods were derived is illustrated in Figure 4.1.

Dissemination of all data is done electronically from SEAN and partner websites. Certain reports are also published by NPS under the Natural Resource Technical Report (NRTR) and Natural Resource Report (NRR) series. No other dissemination methods are maintained by SEAN.

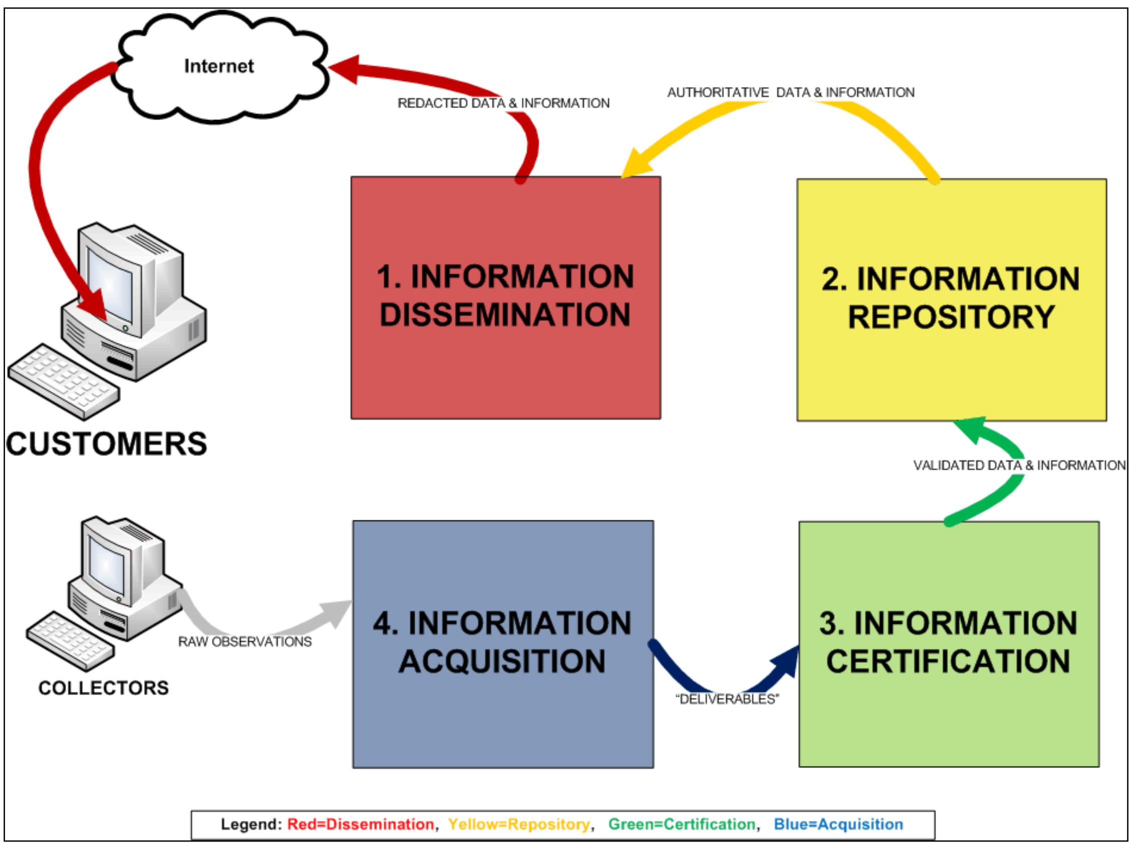

Figure 4.1. The SEAN core functional model is based on first determining which specific monitoring products are most useful to customers. Dissemination services (red) provide all specific deliverables to all customers using Internet web servers. Repositories (yellow) store the certified inventory and monitoring products called for in the protocols. Certification processes (green) assure repositories have the highest quality data and that sensitive items are restricted to authorized users. Data acquisition processes (blue) led by park staff and cooperators include a wide array of tasks, ranging from collecting raw data to producing reports on long-term trends.

4.2 Overview of Data Products

The oceanography program creates and maintains 12 specific data products for customers, referred to in this document as deliverables. Each deliverable is disseminated from SEAN and, in selected cases, partner websites. The SEAN website is the single authoritative source for these deliverables. In the event that an oceanography data product distributed by a partner ever diverges from the values disseminated by SEAN, the SEAN version should be used.

The deliverables are summarized in Table 4.1 and each deliverable is fully defined in Appendix J. Accompanying each definition is a data flow diagram illustrating where underlying data come from, what processes are applied to them, where they are stored, and who is responsible for managing each of them (Figures J.1–J.12).

SOPs present the detailed algorithm for creating each deliverable. Table 4.1 includes a column referencing the appropriate SOP to use in building each one.

Table 4.1. The SEAN data deliverables provided by this monitoring program

Deliverable Title	Description	Provided to Customers as	Frequency Produced	Responsibility	SOP
OC_A: CON calibration files	The collection of calibration files used to adjust raw CTD data to standard levels based on the particular sensitivity of each sensor in the instrument array	Windows files in the proprietary CON format of vendor Sea-Bird Electronics	Typically, once per year after the annual instrument calibration has been performed. May be done more frequently if CTD is recalibrated due to sensor failure.	Project Leader	3
OC_B: raw HEX files	The collection of raw CTD data taken in one cast. One HEX file is created per cast. Values represent relative voltages or frequencies sampled from sensors.	Windows files in vendor's ASCII HEX format, wrapped into a single .ZIP file	One ZIP file per year	Data Steward	6
OC_C: processed CNV files	The collection of raw data processed against calibration factors, binned into 1 m segments, and expressed in engineering units. One CNV file is created for each cast.	Windows files in vendor's ASCII CNV format, wrapped into a single ZIP file	One ZIP file per year	Data Steward	8
OC_D: cumulative database	A single cumulative database of all certified OC_C data. Customers extract data onto their workstations after specifying filter parameters such as year, depth range, etc.	ASCII CSV files downloaded from web and saved onto local workstations.	Continuously available	Data Manager	10

Table 4.1. The SEAN data deliverables provided by this monitoring program (continued)

Deliverable Title	Description	Provided to Customers as	Frequency Produced	Responsibility	SOP
OC_F: NODC data submission	The data in OC_D are delivered by SEAN to National Ocean Data Center (NODC), who combine incoming data with other holdings and redistribute them to the public and researchers.	Various forms, as defined by NODC	Data are updated periodically from the SEAN database as they become certified; typically once per year.	Data Manager	17
OC_H: field log sheets	Two-sided color scans of the original field log sheets	One PDF file website containing one November–October year	Once per year	Project Leader	12
OC_I: protocol	This protocol document, explaining the complete details of the monitoring program as currently implemented	One PDF file	As required	Program Manager	18
OC_J: data availability matrix	Data availability matrix documenting which parameters are available in the OC_D database by month and year	One cumulative PDF file covering all years	Typically once per year after certification of the latest OC_D.	Data Manager	13
OC_K: annual data report	Annual report summarizing operations and data	One PDF file	Once per year after certification of the corresponding OC_D	Project Leader	14
OC_L: Five-year report	Five-year analysis reviewing trends in the collected parameters	One PDF file.	Once every fifth year after completion of the most recent OC_K annual report	Project Leader	15
OC_M: data quality assignment	Data quality adjustment report used to flag database rows judged to be anomalous for various reasons	One PDF file. Also incorporated into the OC_D downloadable database	Once per year after certification of the latest OC_D	Project Leader	11

4.3 Dissemination: Accessing the Data Deliverables

In keeping with SEAN's data management policies, customers may access all of the oceanographic program's deliverables directly from SEAN's public web site. The web site also contains useful ancillary information and references to relevant published and gray literature. Figure 4.2 illustrates main page content. In order to highlight the links between the content in Table 4.1 and the website, Figure 4.2 is annotated with deliverable IDs in blue. Pages also provide access to formal Federal Geographic Data Committee (FGDC) metadata in Extensible Markup Language (XML) format for each specific deliverable type, where appropriate. Figure 4.2 is intended to illustrate content only. The actual layout, graphics, and enterprise links used will follow the latest guidance of the national Inventory and Monitoring (I&M) program. While the dissemination services are publicly available worldwide, the target audiences are NPS resource managers and specialists as well as the broader scientific community.

Copies of final certified data are also distributed to NODC for further dissemination. NODC is a branch of the National Oceanic and Atmospheric Administration that has served as an oceanographic data repository since 1961. The NODC archive is the largest collection of publicly accessible oceanographic data in the world (see http://www.nodc.noaa.gov/). SEAN does not control program data once NODC assimilates it into their operations, nor does SEAN manage NODC data's currency or update schedules. Should discrepancies be found between NODC and SEAN data, SEAN is the authoritative source.

Selected certified deliverables and their metadata are also installed in NPS's Integrated Resource Management Applications (IRMA) Data Store for further dissemination (http://irma.nps.gov/). Should discrepancies be found between copies of deliverables in IRMA and original SEAN website products, SEAN is the authoritative source.

In the SEAN model, as depicted in Figure 4.1, a Project Leader is also a customer. When creating a product based on earlier deliverables (e.g., annual or five-year reports), the Project Leader uses as source material the certified SEAN deliverables from the web; the Project Leader's local work files are not used. This process assures that deliverable creation processes only use authoritative data and, therefore, results are reproducible. For example, OC_C (processed CNV files) is created using OC_B (raw HEX files) and OC_A (CON calibration files). To create OC_C, the leader first downloads the certified OC_B and OC_A deliverables to his workstation. The Project Leader's locally retained files originally used in submitting OC_B and OC_A are ignored, as it is possible they could have become altered copies that diverge from certified products.

No deliverables of the oceanographic monitoring program are currently considered sensitive. Should a future policy revision make something sensitive, it will be sequestered at SEAN and will not be available for general dissemination. Questions regarding existence of sequestered products should be directed to the Data Manager through the "Contact Information" link of the website.

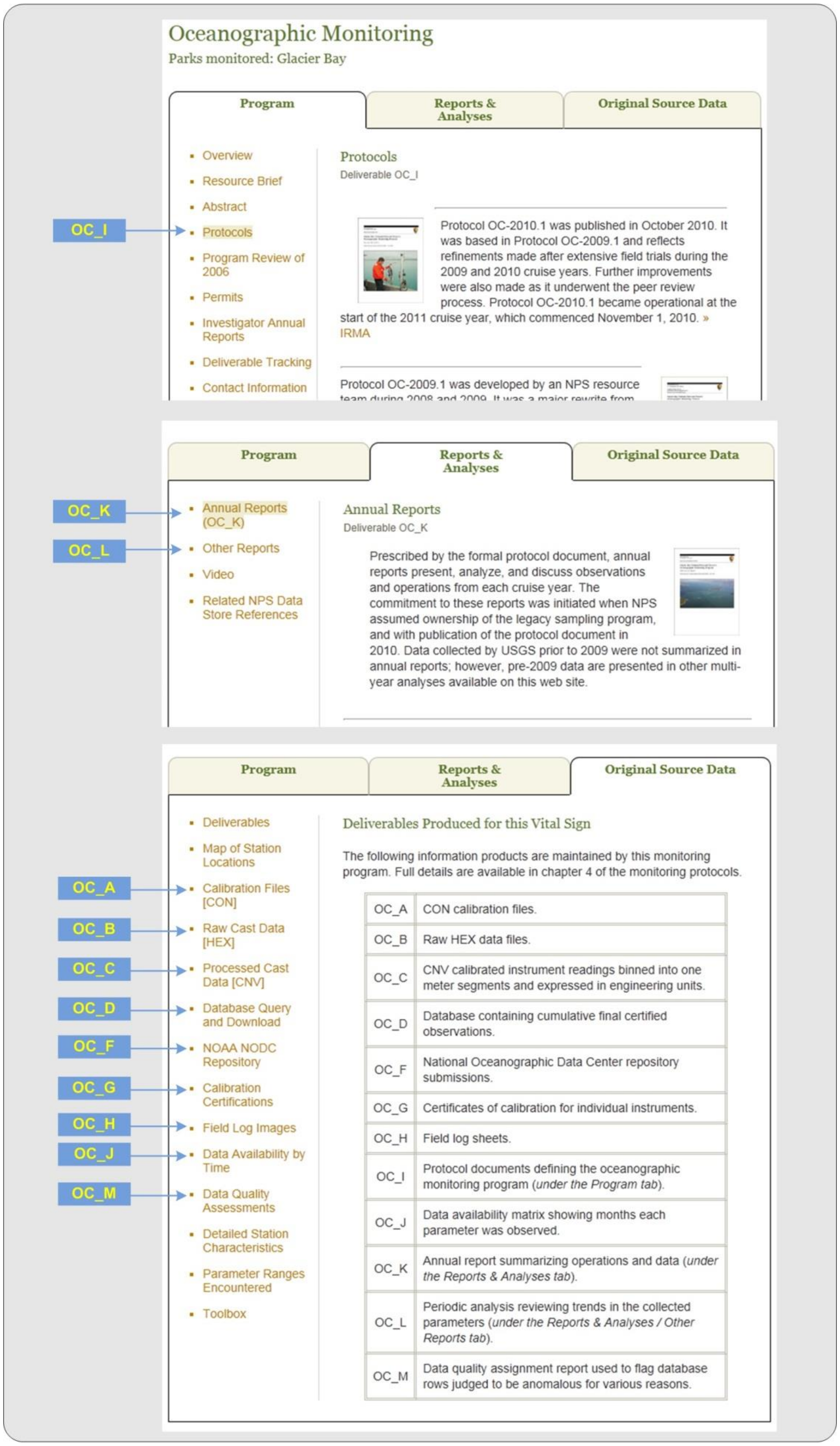

Figure 4.2. Deliverable references reflected on the oceanographic monitoring program's web pages.

4.4 Repository: Data Archiving

Oceanographic program data are maintained in SEAN's Auxiliary Repository on equipment located in the SEAN office in Juneau, Alaska. Parts of the SEAN Data Management Plan detail the Juneau backup and restore mechanism (Johnson and Moynahan 2008, SOP 204: Backup and Restore Routines; SOP 1101: Network Archiving Process). That same document lays out in Chapter 11 the philosophy of records management at SEAN.

Content of the Auxiliary Repository is also mirrored at the Production website and database facilities of the NPS Natural Resource Stewardship and Science group (NRSS), from which it is publicly disseminated. The NRSS uses enterprise-level business continuity processes to maintain their mirror of SEAN's repository.

Original copies of OC_F submissions to the NODC repository are retained in a safekeeping area of the Juneau network. Doing so permits reconstruction of a failed partner repository. Similarly, NODC archives support reconstruction of SEAN databases in the event of disaster.

OC_K annual reports and OC_L five-year analyses are published as NRTR documents and archived in the agency's IRMA Data Store repository. A cumulative comma-separated value file containing the OC_D database for all years is also archived in the Data Store.

4.5 Deliverable Validation and Certification

This protocol explicitly defines in Appendix J the set of mandatory and optional validation criteria for every deliverable in the oceanographic monitoring program.

Each deliverable goes through rigorous validation processes to ensure it meets all mandatory quality control criteria. After a submitted product meets all mandatory criteria, the originator reviews the final version and, if completely satisfied, certifies it. Once certified, the Data Manager installs it in the repository and ensures it is properly accessible from the dissemination website. The SEAN Data Management Plan describes the approach to validation and certification (Johnson and Moynahan 2008, Section 6.4 and SOP 601: Procedures for Certifying Project Data).

Certification requires orchestrating a set of tasks between the Project Leader and Data Manager (generically depicted in Figure 4.3). For each deliverable, these tasks are detailed in their respective SOPs. Specific interactions between Project Leader, Data Steward and Data Manager are graphically illustrated for each deliverable in the data flow diagrams in Appendix J.

4.6 Data Acquisition: Scheduling Deliverable Production

A set of prerequisites must be completed before most deliverables can be generated. That is, creating some deliverables may depend on prior certification of other deliverables, which in turn may have their own dependencies. Figure 4.4 illustrates the typical order used in creating the products. Besides formal deliverables, key intermediate processes are also noted in the proper sequence. Due to the numerous circumstances and exceptions one may encounter while operating the monitoring program, it may be necessary to revise the order of execution ad hoc. Figure 4.4 is only an example; the Project Leader may identify acceptable variations. Any substantial permanent variations must be formalized in future protocol revisions (SOP 18).

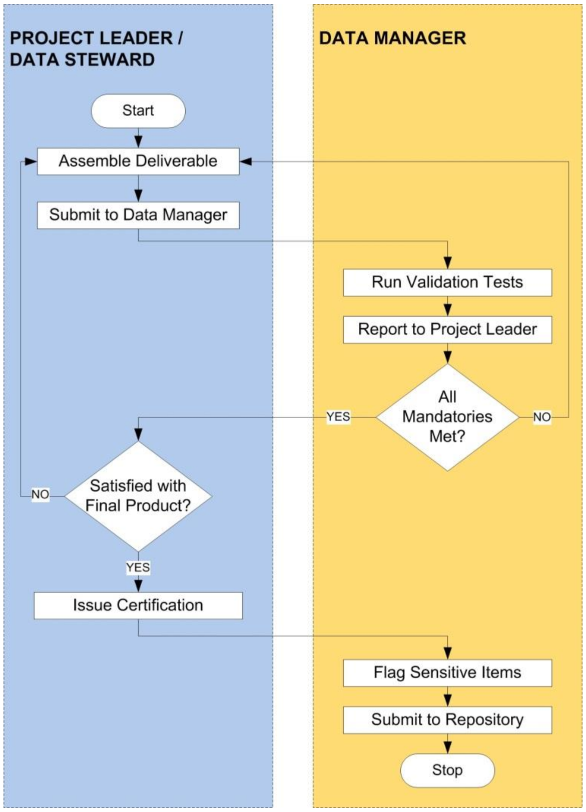

Figure 4.3. Sequence of tasks and staff responsibilities used in the SEAN certification process.

4.7 Managing the Production Environment

In order for users of the Internet to have access to I&M products, the content is required to be housed on what are called "production" file servers, database servers, and web servers. These are currently physically housed in Colorado. Only fully vetted, permanent items are allowed in the production environment. The SEAN maintains its own environments in order to prepare content for production. These are known as the Development and Staging/Integration environments. They reside on their own servers located at the SEAN offices.

The technical details to observe in preparing program data products and installing them in production are addressed in SOP 16: Managing the Production Environment.

4.8 Metadata Maintenance

The Data Manager is responsible for maintaining FGDC-compliant metadata for each tabular deliverable. SEAN stores metadata as XML files and serves them on the SEAN webpage, alongside the deliverables they describe. SEAN uses NPS Metadata Editor and the NPS_Basic_Edit stylesheet for basic entry. Where data fields exist, SEAN extends the basic metadata by providing the Entity_and_Attribute_Information section. Metadata considerations are further addressed in Chapter 8 of the SEAN Data Management Plan (Johnson and Moynahan 2008).

4.9 Precertification Data Delivery

At times, users may benefit from having access to the data soon after a particular cruise, rather than waiting for the year-end certification process to be complete. For example, a researcher who is planning an early summer expedition to Glacier Bay could benefit from seeing the late spring vertical profiles. For these time-sensitive cases, the Project Manager can be contacted directly and will arrange on an ad hoc basis to deliver the requisite HEX and CON files. The postcruise raw in-season data plots can be disseminated in the same fashion. The intent is to provide useful (but raw and lower quality) data to those with immediate need. Also see Chapter 7 for suggested future improvements regarding the dissemination of near real-time data.

PRESEASON

Deliverable	Comment
OC_G: CTD calibration certificate images	For the primary CTD to be used this season
OC_A: CON calibration file	For the primary CTD to be used this season

IN-SEASON

Cruise 1…*n*

Day 1…*n*

Cast 1…*n*

Fill in field log sheet
Have CTD collect readings

Dump CTD to laptop files and backup USB drive
QA files visually
Clear data from CTD

Post cruise

Copy laptop files to network storage
Quality check raw data by plotting HEX files
File field log sheets for postseason use

POSTSEASON

Send CTD(s) used during this season out for calibration

Deliverable	Comment
OC_H: field log sheet images	One PDF for whole season
OC_B: raw HEX files	One ZIP for whole season
OC_C: processed CNV files	One ZIP for whole season
OC_D: database rows	Generated from OC_C by Data Manager
OC_G’: calibration certificate images	Available after CTD returns from annual calibration
OC_A’: CON calibration file	Available after CTD returns from annual calibration
OC_M: data quality report	Applied to OC_D by Data Manager
OC_J: data availability matrix	OC_C must be certified before updating OC_J
OC_F: NODC submission	Generated from OC_D by Data Manager
OC_K: annual report	Generated from OC_D by Project Leader
OC_L: five-year report	Generated every fifth year from OC_D by outside experts
OC_I: revised protocol	No fixed schedule; implement at start of a season

Figure 4.4. Typical order of operations. Calibration files and documents (OC_A and OC_G) created at the end of the prior cycle must be available for the current season. During fieldwork a number of tasks must be performed in the depicted sequences. At the end of the season new calibration products must be obtained (OC_A’ and OC_G’) in order help flag data exceptions (OC_M). Following the order depicted for postseason deliverable creation will assure prerequisites are met in generating the cycle’s full set of products.

5.0 Personnel Requirements, Qualifications, and Training

5.1 Roles and Responsibilities

Field efforts, comprising the hydrographic survey and undertaken by the Project Leader and Vessel Operator, are detailed in SOP 4. CTD care and maintenance, data download, and plot generation are performed by the Project Leader, following the procedures in SOPs 1–3 and 5–7. The validation process is the joint responsibility of the Project Leader, Data Steward, and the Data Manager (SOPs 2, 3, 6, 8, 10–15, and 18). The resulting certified deliverables are installed in the NPS repository archive, incorporated into web dissemination links, and transmitted to external facilities (SOP 17) by the Data Manager. Following is a list of responsibilities for each role.

5.1.1 Project Leader (presently Lewis Sharman, ecologist, GLBA)

- Work with the Vessel Operator (as necessary: currently Sharman is also the Vessel Operator) to schedule and execute a safe cruise that achieves all sampling objectives.
- Initiate or discontinue sampling as dictated by weather conditions or the general safety of personnel and equipment.
- Complete precruise confirmation of the CTD instrumentation, power, memory, and configuration for proper operation.
- Complete CTD field log at each station.
- Deploy CTD at each station.
- Ensure proper storage and maintenance of the CTD instrumentation and associated sampling hardware.
- Ensure CTD is sent to manufacturer(s) for periodic calibrations/repairs and received back in timely fashion.
- Plot vertical profile immediately following the first cast of each cruise to demonstrate correct CTD performance and data quality.
- Verify proper data collection and overall quality at the end of each day's sampling, including entering CTD field log information into a station summary spreadsheet.
- Generate files of 1 m bin averaged parameter values from raw data.
- Ensure postseason calibrations have been checked and applied if needed.
- Assess and record the quality rating of each cast.
- Complete and submit to the Data Manager the assigned data deliverables specified in Table 4.1 and defined in Appendix J.
- Assemble documentation of exceptions and notable observations recorded in field notes, for use in the annual report.
- Verify any required permits are current and in order.
- Submit investigator annual reports.
-

5.1.2 Vessel Operator (varies; presently GLBA operator of the Fog Lark, with support as needed from qualified operators of alternative vessels Capelin, Arete, Talus, Rebound, or Boomer)

- Operate, fuel, and maintain vessel.
- Work with the Project Leader to schedule and execute a safe cruise that achieves all sampling objectives.
- Initiate or discontinue sampling as dictated by weather conditions or the general safety of personnel and equipment.

- Assist the Project Leader as needed to execute the CTD casts.

5.1.3 Data Steward (presently Chris Sergeant, SEAN)

- Submit deliverables defined in Appendix J to Data Manager for evaluation against formal criteria.
- Apply necessary corrections to data products and resubmit until they meet required standards.
- Confer with Project Leader regarding data and metadata issues.
- Create standard tables and figures for annual reports.

5.1.4 Data Manager (presently Bill Johnson, SEAN)

- Complete the assigned data deliverables specified in Table 4.1 and defined in Appendix J.
- Validate quality of deliverables against formal criteria in conjunction with Data Steward.
- Build facilities to disseminate these products over the web.
- Maintain metadata.
- Manage project progress and adherence to schedules.
- Archive data at:
    - The SEAN websites
    - The NPS IRMA Data Store
    - The national NODC repository
    - Coordinate updates so that these archives continue to represent the best project data.

5.2 Qualifications

5.2.1 Project Leader

- Knowledge of at-sea field sampling operations, protocol details, and safety policies
- Familiarity with CTD instrumentation, data collection, and deployments
- Ability to download data files to a computer, process, plot, and evaluate profile quality
- Expertise in correcting errors detected in data deliverables
- Project management skills

5.2.2 Vessel Operator

- Basic seamanship skills
- Small boat operations, including safety procedures
- Small engine operation and maintenance
- Operation of marine communication and navigation electronics
- Use of marine hydraulics
- Local area knowledge

5.2.3 Data Steward

- Thorough understanding of SOPs for data deliverable creation

5.2.4 Data Manager

- Expertise in database management
- Expertise in web programming
- Data processing, validation, reporting, and archiving skills
- Project management skills

5.3 Training Procedures

5.3.1 Project Leader

- Operational leadership
- Review General Safety Plan and Job Hazard Analysis (see Appendix E)
- CTD operations and maintenance
- Field log recordkeeping procedures
- Postcruise data quality check and visualization techniques
- Sea-Bird CTD data processing techniques

5.3.2 Vessel Operator

- Operational leadership
- DOI Motorboat Operator Certification course or appropriate USCG license
- Marine navigation
- Marine weather forecasting
- Review General Safety Plan and Job Hazard Analysis (see Appendix E)

5.3.3 Data Steward

- Desktop software skills

5.3.4 Data Manager

- Technical database management
- Technical web development
- CTD configuration and operations
- CTD data processing software

6.0 Operational Requirements

6.1 Annual Workload and Field Schedule

After the closing cruise in October, the Project Leader must ship the primary CTD for that year (and backup if it had been deployed) to the vendor for calibration, any necessary repairs, and preventive maintenance. Packing, tracking, and receiving requires about two person days. The field season begins with the midwinter cruise of December–early February. Each field year may span two calendar years, beginning with a December–early February cruise and ending with the October cruise. Approximately 20 field days each per year are required for a Vessel Operator and CTD perator to complete this sampling, distributed over the following schedule:

- December–early February: three days (winter weather permitting) to sample stations 00–14, 16–21, and 24
- March, April, May, June: two days each month to sample stations 01, 04, 07, 12, 13, 16, 20, and 24
- July: two days to sample stations 00–14, 16–21, and 24 (in good weather and extended daylight: otherwise three days)
- August, September, October: two days each month to sample stations 01, 04, 07, 12, 13, 16, 20, and 24

The target date range of sampling for each core station cruise (March–June and August–October) is the first full week of the sample month. This ensures buffer time in case weather constraints prohibit sampling during the target week. One exception is the June sampling cruise, for which the target date is May 31 (station 20 is currently inaccessible during the June 1–July 15 closure to motorized vessels). Similarly, the target date of the July all stations cruise is July 16, when stations 19 and 20 in upper Muir Inlet become accessible following the same closure. The approximately 70-day (December–early February) target date range of the winter all-stations cruise is intentionally broad due to shorter days and challenging winter weather. With advance planning, core station monthly surveys can frequently be accomplished in a single extended day, saving up to seven ship days per year.

In addition to the field efforts described above, approximately four hours are required to set up and stow sampling equipment before and after each cruise, for a total equivalent of nine days per year. Approximately one-half person-day per cruise is required for the CTD operator to download data, transfer data to the archive, and make initial quality-control plots so that if instrument problems are exhibited in the data, they can be corrected before the next field effort (4.5 days per year). Processing data to the final OC_D level takes place annually after manufacturer calibration results are received; this requires five days in December or January. Approximately 10 days is required to assemble the annual final report, typically during February to April.

We strongly recommend development of full redundancy in personnel capabilities for field sampling (CTD operation). Doing so reduces the burden on any one individual and ensures operational continuity in the inevitable instance of Project Leader schedule conflict, absence, or turnover.

Combined Data Manager and Data Steward duties require approximately 10 days per year.

In aggregate, personnel resources dedicated to this program include the following tasks and estimated time requirements:

- Vessel operator: 12–20 days per year
- CTD operator: 20–28 days per year
- Data verification and processing: 5–10 days per year
- Annual report generation: 10 days per year
- Five-year report generation: 20 days every five years
- Data management: 10 days per year

Note that in many cases the vessel operator and CTD operator may be the same person, although field sampling does require a minimum of two people; the second person can be an additional minimally trained Glacier Bay/SEAN employee or volunteer. Note also that the five-year report may be outsourced, further reducing staff resource requirements.

6.2 Facility and Equipment Needs

- Vessel for conducting research, equipped with:
  - Fuel
  - GPS system
  - Depth sounder
  - Davit or boom and hydraulics for hauling line or equivalent
  - Survival suits
  - Float coats or vests
  - Communications (park radio, marine VHF radio)
  - Emergency beacon (EPIRB or emergency position indicating radio beacon)
  - SPOT location tracker
  - General emergency supplies
- Redundant CTD system with ancillary sensors and associated hardware and spares as described in Section 6.3 below
- Heated storage facility and shop area for CTD instrumentation, line, miscellaneous hardware and spares
- Laptop computer with necessary software, data transmission cable, and connectors
- Backup USB drive
- Data processing and archive facilities on the local area network

6.3 Startup Costs and Budget Considerations

The continued success of the program depends to a considerable extent upon certain direct support from GLBA. This support is principally in-kind (rather than outright funding) and takes the form of the following:

- Provision of a park vessel (typically the R/V *Fog Lark*) as oceanographic sampling platform, with operator (see Section 5.1.2) and associated maintenance, fuel, etc. (approximately 12–20 days per year, see Sections 6.1–2)
- Provision of a park employee (Project Leader, see Section 5.1.1 and Section 6.1) capable of conducting field surveys, maintaining the instruments and equipment, and downloading, processing, and periodically reporting out the data (approximately 50 days per year)

- Occasionally the Project Leader will require an assistant (in addition to the Vessel Operator) capable of assisting with the field surveys (estimated requirement 10 days per year). This assistant may be park or SEAN staff or a capable volunteer.

To ensure uninterrupted sampling, SEAN will need to procure a new set of instrumentation approximately every 10 years, on a schedule starting with 2010. In 2009, the cost of a complete CTD system with all ancillary sensors was approximately $25,000.

A backup CTD is maintained and provides multiple benefits:

- Allows annual recalibrations to take place without impeding field efforts if the calibration facility is unable to effect a rapid turnaround—a common occurrence.
- Allows the sampling program to keep pace with state-of-the-art instrumentation advances on an appropriate timescale.
- Allows SEAN to plan and budget for gradual instrumentation replacement over time.
- Provides instrument redundancy in case of failure. Examples of failure include common field problems (corroded connector pins, cracked conductivity cell, damaged interface cabling) as well as uncommon problems (flooded pressure housing, battery leakage, total instrument loss due to tethering line failure).

The current CTD inventory includes a 1994-vintage Sea-Bird Model 19 CTD (CTD #1), containing internal memory (~43,300 "samples") sufficient to store approximately 10 casts' worth of data from Glacier Bay stations. An additional system (purchased new in 2010) is a Model 19-plus V2 (CTD #5), which contains considerably more internal memory (~3,463,000 "samples") sufficient to store 850 to 900 casts. Both systems are capable and robust, and sensor data are all fully comparable, but it is important to remember that the reduced internal memory of CTD #1 requires that it be downloaded and the memory initialized every 10 casts at maximum.

Starting with the 2013–2014 oceanographic sampling year, the two CTDs are alternated one year on and one year off, with calibrations remaining valid for both instrument systems at all times. This ensures that calibrated back-up sensors are always available and that the second CTD is ready for deployment immediately upon the start of a new sampling year. This eliminates any risk of a delayed start of the midwinter cruise due to late delivery of any calibrated sensors or a suspension of operations due to catastrophic loss of the primary instrument. Refer to SOP 1 for the complete schedule of sensor calibration.

Calibration costs of $2,500 to $3,000 per year per CTD (including shipping costs) are required to ensure overall reliability of the collected data from the primary CTD. If the backup CTD gets deployed during a particular year it must also be calibrated at a similar cost.

Funds for miscellaneous operations and field supplies (see Appendix C) are also needed on an ongoing basis (less than $500 per year).

Access to the SEAN-dedicated vessel (*Fog Lark*) that minimizes scheduling conflicts allows the SEAN to effectively and efficiently plan and execute field surveys as weather windows open. This vessel also greatly enhances the effectiveness of vessel-based monitoring of other vital signs (e.g., Kittlitz's Murrelets, Marine Contaminants, Weather and Climate).

Depending on the available expertise in-house at SEAN/GLBA, both annual data reports and the five-year syntheses may benefit from collaboration with an external oceanographer to assist with the analysis, interpretation, and reporting of the collected data. The need to engage a subject matter expert is a function of staff composition at a particular time and cannot be determined in advance. If required, it is estimated annual report work would cost approximately $4,000 and synthesis report would be about $20,000.

6.4 Protocol Revision Process

This protocol will be updated or revised as new knowledge, technologies, equipment, and methods become available. Revisions will balance the advantages of new techniques with possible disadvantages associated with disrupting data continuity. Maintaining an unbroken, consistent dataset is highly desirable.

All revisions require review for clarity and technical soundness. Minor changes to the current protocol document—for example, formatting; clarification of existing content; alterations to the task schedule, work flow, or project budget; simple detail updates to SOPs—may be reviewed in-house by project cooperators and SEAN staff. Major changes—such as altering sampling design, parameters measured, or analytical techniques—will trigger an external peer review to be coordinated by the Alaska Region I&M coordinator.

The SEAN Program Manager will periodically poll the Project Leader and Data Manager on the need to initiate a protocol revision cycle. Every effort will be made to ensure that complete, certified protocol revisions are applied at the start of a new cruise year (i.e., after the October cruise and before the winter cruise). Exceptions (requiring that a change be instituted immediately) include revisions that would remedy an identified safety deficiency or a significant issue affecting data quality or continuity of operations.

The protocol document is defined as data deliverable OC_I. Technical details of the method for protocol revision are specified in SOP 18.

The protocol revision process will be cooperatively managed by the Project Leader, SEAN Data Manager, and SEAN Program Manager. In the course of a revision cycle, proposed revisions may originate from any of those three individuals. One of these three people shall agree to be revision coordinator and be responsible for the actual drafting of the document. The revision coordinator will manage proposed contributions and internal tracked-changes until consensus is reached on a final draft document. If an external peer review is required, the coordinator will address received review comments in consultation with the other two participants.

A revised protocol must be given a new protocol identifier, using the form detailed in the SEAN Data Management Plan (Johnson and Moynahan 2008, SOP 602: Version Control). The Project Leader will include a summary and justification of the revision in the first postrevision annual report, under an appropriately titled section. The new protocol publication will be disseminated and archived through standard SEAN practices and will be submitted to appropriate NPS repositories outside SEAN.

7.0 Oceanography of Glacier Bay: Other Considerations

The basic set of deliverable information products outlined in this protocol will ensure attainment of the monitoring objectives, but because the marine ecosystems of both Glacier Bay and the greater northeastern Pacific change over time, new or different methods of analyzing and reporting the data will be developed. Technological advances will allow for more detailed measurements of more parameters, such as high-accuracy and high-precision pH. It is important that SEAN and GLBA maintain the observations currently specified within this protocol but remain open to next-generation technologies that may improve measurement and description of the oceanographic ecosystem.

By adding two person-days per cruise (18 days per year total), in-season data files, plots, and tables (profiles, anomaly plots, cross-sections, statistical analyses) could be distributed via the SEAN and GLBA webpages immediately after a cruise (though these products would not be formally validated using postseason calibrations). One of these two person-days would be allocated for compiling the data and generating the plots and tables. The second day would be designated for installing the data files and plots into the SEAN repository and webpage. Some time would be required to fine-tune this effort so that it could be done efficiently and repeatedly. Implementing this service would increase the overall value of the collected data because it would enhance the ability of users to reliably incorporate the data into time-sensitive applications. Such applications include support of in-season field research, support of real-time nowcast/forecast models, support of near real-time oceanographic reanalysis programs, and possible support of in-season resource management issues that impact the greater Gulf of Alaska marine system.

Another item to consider for the future is what response the SEAN should undertake if a set of highly unusual events were to be observed. Presently, the program does not have a procedure in place to identify in a timely fashion or meaningfully follow up on such occurrences. Having the ability to more closely investigate anomalous observations would (1) provide a re-verification of the initial observation, and (2) provide the ability to opportunistically sample and better understand such events and their greater implications. For example, if bottom water at a station were observed to have been anoxic during a survey, such a procedure could specify that (1) cast data from all other stations be closely inspected to ensure that the sensor appears to be operating properly, and (2) during the next monthly survey a series of multiple casts would be performed at that station, with special attention to ensuring that near-bottom water was accurately measured.

The monitoring program outlined herein has been designed to document oceanographic conditions from representative domains within Glacier Bay. This program provides a solid foundation for understanding the oceanographic environment, but there remain many gaps to be acknowledged and addressed if opportunities present themselves. For the physical fields, limited spatial and temporal coverage of selected parameters lead to incomplete snapshots of the physical system. While the ancillary sensors on the CTD comprise a cost-effective attempt to go beyond the basic physics, this oceanographic program is yet incomplete with respect to the monitoring of chemical properties and the bacterial, phytoplankton, microzooplankton, and zooplankton communities.

GLBA and SEAN should support future process-oriented research that focuses on better describing the dynamics and community makeup of the portions of the ecosystem currently not sampled. Such studies would increase the value of the monitoring dataset by placing results within a broader ecological context. Examples of such process studies include those outlined below.

7.1 Physics

- Tides: Twenty-four hour to one month tidal cycle hydrography and current studies at various locations along and across the bay will put individual stations into a high-resolution temporal frame of reference.
- The near-shore environment: Describe physical conditions and transport processes in biological “hotspots” to better predict and understand regions of high biological densities and productivity. Study freshwater dynamics, from coastal discharge to mixing processes, to help link terrestrial, glacial, and marine processes.
- Mooring, autonomous underwater vehicle (AUV), and surface radar deployments: Provide descriptions of both low-frequency and high-frequency modes of system change, including tidal processes, deep-water renewal, and the phasing of system changes throughout the water column.
- Oceanographic linkages: Determine the level of connectivity with and influence of waters outside Glacier Bay upon those inside the bay, and vice-versa. Determine relationships with oceanographic and meteorological patterns on larger scales.

7.2 Chemistry

- Nutrient budgets: Document the nutrient dynamics and nutrient transfer pathways within Glacier Bay in order to better understand this productive ecosystem.
- Ocean acidification: Study Glacier Bay as a high-latitude early warning system for ocean acidification.

7.3 Primary Production

- Phytoplankton bloom dynamics:
- Document the in situ phytoplankton species composition. Investigate spring bloom and episodic production events through the summer in order to determine relative importance to overall productivity.
- Determine the role of tidal mixing in maintaining primary production.
- Explore limitations to production through the summer and how they affect phytoplankton community structure.
- Investigate the role of tidewater glaciers in patterns of primary productivity, and document changes as glaciers recede/advance.

7.4 Secondary Production

- Zooplankton communities:
- Document the structure and dynamics of the dominant zooplankton communities that feed the fish, seabird, and marine mammal populations. Investigate spatial and temporal abundance of meroplankton (larvae) for commercially and ecologically important species (e.g., crabs, clams, mussels).

In regard to data management, the current resolution of data quality assignment applies to all parameters within a depth bin. Therefore, all parameters in a bin may be disqualified from analysis even if only one sensor exhibits a fault. Increasing the data quality resolution by assigning it individually to every attribute in each bin may improve the accuracy of certain analyses. However, this would incur significant ongoing costs to implement. Execution would require staff to review large numbers of data points for each sensor and manually flag many of them in the database. A cost/benefit analysis regarding increasing data quality assignment resolution to the individual parameter level, based on behavior seen in existing historical data, might suggest these improvements to the dataset would be worthwhile.

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SOP 1: CTD Maintenance, Storage, and Calibration

1 CTD Maintenance, Supplies, and General Handling Procedures

Two CTDs are used in this program. One is referred to as "primary" and is intended to be used for an entire season. The second is called "backup" and is kept in reserve for use only in the case that the primary device suffers failure and must be sent out for repair. Typically, two devices are rotated through these positions, each operating as primary every other year.

1.1 General CTD Handling, Care, and Use Instructions

The Sea-Bird SBE-19 and SBE-19plus V2 operators' manuals (available on the SEAN and Sea-Bird websites) document all recommended practices for cleaning the CTD, accessing the battery compartment, care and installation of O-rings, instrument operation, instrument setup, and CTD-computer communications. The Project Leader will read and become comfortable with all aspects of the manual.

Based on SBE Application Notes 34, 2D, and 64 (http://www.seabird.com/application_notes/ANindex.htm) and further consultation with SBE technicians, the following within-a-single-cruise-day procedure has been adopted. After each cast (within a single day), the plumbed line connecting the pump and sensors should be flushed with ambient-temperature 0.1% Triton X-100 solution (note: Triton X-100 is a nonionic biogenic detergent; be careful not to get the solution in eyes or on skin) followed by distilled water, using the syringe/tubing assembly and leaving the assembly attached to the open end (nylon hose barb fitting) of the conductivity cell until the next cast (*remember to remove prior to cast!*). This leaves the sensors bathed in distilled water between casts to dissolve any residual salts. During very cold weather (e.g., during the midwinter survey when ambient air temperatures fall below freezing [0 °C]), the syringe/tubing assembly should be removed after the distilled-water flush, allowing the entire plumbed line to drain and reducing the risk of freeze damage to the conductivity cell. Additionally, after each cast the faces of the upward-looking PAR sensor and the downward-facing fluorometer should be rinsed with distilled water from a wash bottle in order to prevent the formation of salt crystals.

Between consecutive days of a multiday cruise (overnight storage), the above procedure is followed except when ambient temperatures are expected to fall below freezing overnight, in which case the syringe/tubing assembly should be removed to allow the plumbed line to drain; in addition, efforts should be made to store the instrument overnight in a heated space to protect the sensors from freeze damage.

For longer-term storage (i.e., between cruises), see Section 2 below.

The above procedure departs from a strict following of the SBE Application Notes based on our local marine and shipboard environments, taking into consideration that the ambient seawater and air temperatures are relatively cool, the seawater salinities are relatively low, the vessel lacks a source of warm and/or deionized water, the time between casts within a day is relatively short (<1 hour), and each cast is preceded by a two-minute surface soak with the pump running. These conditions combine to allow for a practical protocol that adequately reduces risks of sensor fouling, salt build-up, or other contamination while minimizing sensor drift over time.

1.2 Supplies

On an ongoing basis, all field gear should be assessed and repaired or replaced as needed. Necessary equipment and supplies include but are not limited to the CTD lowering line, spare CTD and GPS batteries, the computer-to-CTD interface cable, spare O-rings, cable ties, electrical silicone grease, distilled water, and Triton X-100 solution. A supply of KimWipes or other similar nonabrasive lint-free wiping towel is necessary for proper O-ring handling. The 450 m+ lowering line (3/8" nylon) is marked with blue tapes at 10-m increments except at every 50 m (red tapes) and every 100 m (green tapes). The line should be inspected annually, and missing or damaged tapes should be replaced. Because the first half of the line receives more wear than the second half, the line should be "reversed" end-to-end every two years; note that, minimally, the number of green tapes at the 100-m increments will also need to be reversed. The line should be replaced with new line at least every six years, or more frequently if wear is observed.

2 Long-term Storage

"Long-term storage" means between cruises, and during the one-year "shelf rest" as the back-up unit to the primary instrument in active service. However, if the back-up instrument is not pressed into service during its "shelf rest" then no cleaning is required and it remains in the condition it arrived in when received from calibration service.

2.1 Instrument Cleaning

Thoroughly cleaning the CTD after each cruise is important to maintain sensor viability and reduce the potential for the negative effects of biofouling, contamination by oil, and buildup of salt crystals on the sensors, especially the relatively sensitive and delicate conductivity cell and oxygen sensor. Again, refer to SBE Application Notes 34, 2D, and 64 for detailed long-term cleaning and storage instructions.

First, rinse the entire instrument thoroughly with fresh water. Then, disconnect the tubing connecting the dissolved oxygen sensor to the conductivity cell so that it is not exposed to the following conductivity cell cleaning procedure. Flush the conductivity cell with a 0.1% solution of Triton X-100. Wash the solution back and forth with the syringe. Allow the cell to soak in the solution for one hour. Drain the cell and tubing, and use the syringe to thoroughly rinse with fresh water for five minutes. Soak the cell for one minute with a 500–1,000 ppm solution of bleach (dilute concentrated household bleach at 50 parts fresh water to one part bleach). After the soak, drain and flush with warm (not hot) fresh water for five minutes, finishing with a final rinse with distilled water. Sea-Bird cautions not to use a brush or Q-tip to clean the flow tube on the conductivity cell, as this can alter the calibration or damage the sensor.

After treating the conductivity cell as above, implement the following procedure to prepare the (now disconnected) DO sensor for long-term storage between cruises. Using the syringe, flush the sensor for one minute with a 1% (vs. 0.1%) Triton X-100 solution, preferably warmed to 30 °C (86 °F). Drain and flush with warm (not hot) fresh water for five minutes. Soak the sensor for one minute with a 500–1,000 ppm solution of bleach (dilute concentrated household bleach at 50 parts fresh water to one part bleach). After the soak, drain and flush with warm (not hot) fresh water for five minutes, finishing with a final rinse with distilled water. Assuming there is no danger of freezing, connect the sensor inlet and outlet with a short loop of Tygon tubing. Place a small piece of clean sponge, slightly moistened with fresh, clean water, in the center of the tubing (not near the sensor membrane).

2.2 Storage

After the conductivity cell is thoroughly dry from its last cleaning, store by reattaching the syringe/tubing assembly to seal the dry cell. For long-term storage, keep the DO sensor isolated with its closed tubing loop. *Remember, however, to remove the loop and reconnect the DO sensor to the in-line tubing train on the CTD just before redeploying the instrument on the first cast of the next cruise!*

3 Factory Calibrations

Immediately after each October cruise, ship the entire primary CTD instrument to Sea-Bird Electronics (SBE) for calibration of all sensors. SBE can arrange for any third-party ancillary sensors to be calibrated at the originator's factory and generally be returned in timely fashion. Be sure to get a returned materials authorization (RMA) number from SBE before shipping the CTD to them (http://www.seabird.com/service/rma/rma.aspx). Include a printed SBE Service Request Form in the shipping crate. Ship the CTD via FedEx, and make sure the RMA number is written on the address label. Email the serial number of the instrument to SBE in advance. The serial number may be found by looking inside a unit's CON file. SBE shipping information is as follows:

SEA-BIRD ELECTRONICS, INC.
1808 136th Place NE
Bellevue, WA 98005
Phone: (425) 643-9866
Fax: (425) 643-9554
Email: seabird@seabird.com
Contacts: Mike Handewith, Dave Armstrong, Andy Heard

SBE's website (http://seabird.com/customer_support/retgoods.htm) also has return information.

When the instrument is returned to GLBA by SBE, it will serve as the backup unit for the upcoming cruise year. The previous backup unit should be promoted to primary unit at that time. All sensors in the backup unit (except the dissolved oxygen sensor) will perform adequately with environmentally stable storage in "off-years" and factory calibration once every two years. In this way, rotating two CTD instruments annually will provide both adequate redundancy and accurate readings.

Each DO sensor, however, requires calibration annually. Therefore, after each October cruise, the DO sensor should be removed from the then-backup unit and also be shipped to SBE for service. When it is returned after calibration, it must be reinstalled on its original unit (which is being promoted to primary). Individual sensors should never be interchanged between CTD units. While it may be physically possible to swap sensors, doing so will likely result in incorrect calibration factors being applied when calculating the parameters, resulting in invalid readings. In order to avoid accidentally interchanging DO sensors, it is recommended the detached DO sensor be separately shipped to SBE under a different RMA; having two DO sensors on the same RMA could lead to confusion regarding calibration data when the CON files get updated.

In the event the backup CTD had to be deployed during the just-ended cruise year, then that entire CTD unit should be sent in for calibration instead of just its DO sensor. The results of the calibration for every machine that collected data during a cruise year are required in order to complete the year's data quality assessment as detailed in SOP 9. Typically, when the full CTD is returned it is accompanied by a computer CON file and certification PDF documents to be processed as described in SOP 3 and SOP 2, respectively. When an individual DO sensor (or PAR sensor, as below) is received, it will usually have calibration factors and certifications on paper. Note there are special sections in SOP 3 and SOP 2 for handling this situation.

As alluded to above, some sensors are manufactured and calibrated by a company other than SBE. SBE thus has no direct control over the timeliness of calibration and return of such third-party sensors, and in some cases they have been unable to return the complete fully calibrated instrument in time for the midwinter (December through early February) cruise window. Consequently, in order to ensure that a complete instrument is always available as a backup, it is recommended that immediately following the October cruise the PAR sensor be shipped directly to Biospherical Instruments, Inc., for calibration instead of to SBE. This saves time by obviating shipping, tracking, and communicating calibration details between SBE and Biospherical, Inc.

Biospherical shipping information is:

BIOSPHERICAL INSTRUMENTS, INC.
5340 Riley Street
San Diego, CA 92110
Phone: (619) 686-1888
Fax: (619) 686-1887
Email: biospherical.com

As with SBE, the company website (http://www.biospherical.com) has detailed return information, and an RMA number should be obtained prior to shipping.

SOP 2: Calibration Certificates (OC_G Creation)

Summary

Two cases are possible. First, the sensor servicing company may have provided one or more paper certificates attesting to the calibration parameters as determined on a particular date. In this case, the Project Leader must generate one PDF file for each document using a document scanner and appropriate software. Second, the sensor servicing company may have provided a CD or DVD already containing PDF files of the certificates.

Once the PDFs are available, they are copied to a park network drive, renamed following a consistent convention, and run through the validation and quality assurance iterations until certified and disseminated.

SOP 2 requires users to work in the internal NPS network under valid Active Directory accounts. Access questions should be directed to the Data Manager.

Detailed Steps

A. Certificates on paper received

1. Project Leader tasks
    1. Extract from the service packet only those forms that list sensor parameters and attest to their accuracy.
    2. Scan each form set for a particular sensor into a separate PDF file using park scanner and associated software. Save on park network at \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\Certificate\ where YYYY is the year on the certificate, e.g., 2010.
    3. Rename each file with a reference to its local CTD number, followed by an underscore, followed by sensor type, followed by underscore, followed by the sensor serial number, followed by underscore, followed by calibration date as YYMM.
    4. Local CTD number is 1, 2, etc. as designated in Appendix F. It is not the Sea-Bird serial number.
    5. Sensor types: TEM, CON, PAR, OBS, FLU, DOX, PRE.
    6. Sensor serial number may always be found inside the PDF.
    7. Example: CTD #1 fluorometer calibration certificate of March 2009 would be named 1_FLU_ WS3S-652P_0903.PDF.
    8. Notify the Data Steward that new draft OC_Gs are available for validation, specifying exactly which files are newly drafted for submission.
    9. Confer with the Data Steward on whether these paper submissions require creating a new OC_A CON file deliverable.

B. PDFs on CD or DVD received

1. Project Leader tasks
    1. Copy each PDF that contains a certificate from the CD into \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\Certificate\ where YYYY is the year on the certificate, e.g., 2010.

2. Rename each file with a reference to its local CTD number, followed by an underscore, followed by sensor type, followed by underscore, followed by the sensor serial number, followed by underscore, followed by calibration date as YYMM.
    1. Local CTD number is 1, 2, etc. as designated in Appendix F. It is not the Sea-Bird serial number.
    2. Sensor types: TEM, CON, PAR, OBS, FLU, DOX, PRE.
    3. Sensor serial number may always be found inside the PDF.
    4. Example: CTD #2 pressure strain gauge calibration certificate of February 2009 would be named 2_PRE_ 0436_0902.PDF.
3. Notify the Data Steward that new draft OC_Gs are available for validation, specifying exactly which files comprise the new draft.

C. Regardless of whether paper or CD or DVD files

1. Data Steward tasks
    1. Review that the filenames in the OC_G are properly formed.
    2. Submit these GLBA-situated files via email attachment to the Data Manager for validation, specifying in the message body it is deliverable OC_G, as defined in protocol OC-2014.1. Multiple files are permitted in one submission email.
2. Data Manager tasks
    1. On receipt of the submission, assign the next formal submission number to this file, as found in the master Submission_Log table.
        1. Use the “Update Submission Log” web tool on the NPS network at http://sean-dm.glba.nps.gov/0_submission_update.aspx.
        2. Complete Submission_Log details up through the Submission_Date column.
            1. Due to the nature of this deliverable, there is no formal submission unit scope.
            2. It would aid future users if the submission unit is entered as a comment listing the CTD, year involved, and whether it is pre- or postseason calibration; see existing entries for examples.
    2. If this is the first OC_G submission for the calendar year, update the deliverable tracking spreadsheet with the date of first submission under OC_G.
    3. Save the file(s) in the staging area for validation
        1. Be sure the filename matches the required form listed above.
        2. The staging location is \\sean.glba.nps.gov\DATA\SEAN_Data\Staging\OC\OC_G\NNN\, where NNN is the submission number.
    4. Validate the submission according to current criteria.
    5. Record validation summary data in the Submission_Log.
    6. Set status code to V if mandatory validation passed. Then update the deliverable tracking spreadsheet with the date of validation for OC_G.
    7. Set status code to F if mandatory validation failed.
    8. If submission fails mandatory criteria,
        1. reply to both Data Steward and Project Leader with a “failure email” that includes:
            1. The submission number assigned

            2. The deliverable ID
            3. The protocol ID
            4. Documentation listing all the specific mandatory criteria failed
        2. Update the submission log with error counts, date validation attempted, and status of F for failed.
    9. Otherwise, if submission passes mandatory criteria, reply to both Data Steward and Project Leader with a "success email" that includes:
        1. The submission number assigned
        2. The deliverable ID
        3. The protocol ID
        4. Documentation listing any specific optional criteria failed
        5. Request to certify deliverable for dissemination
3. Data Steward tasks
    1. On receipt of a failure email:
        1. If failure is due to filenames or other readily correctible issue, perform correction and resubmit.
        2. If failure is due to other reasons, request Project Leader make corrections by rescanning, recopying, and/or obtaining corrected documentation from the vendor. Then restart the process from the beginning.
    2. On receipt of a success email, review any failed optional criteria:
        1. If these are acceptable:
            1. Reply to both Project Leader and Data Manager with a "certification email" stating the deliverable is certified and may be disseminated.
            2. Notify Project Leader to store related forms or CDs in a physical file at GLBA.
        2. If these are unacceptable:
            1. Reply to both Project Leader and Data Manager with a "withdrawal email," stating the deliverable is withdrawn.
            2. Take remedial action to obtain a corrected deliverable.
            3. Restart the process from the beginning.
4. Data Manager tasks
    1. On receipt of a withdrawal email:
        1. Mark the withdrawal in the Submission_Log's Status column using the web tool.
        2. Terminate the process.
    2. On receipt of a certification email:
        1. Verify no sensitive information is in the deliverable.
            1. Products containing sensitive information cannot be disseminated.
            2. Sensitivity is quite unlikely for this deliverable.
            3. If sensitive,
                1. Copy the submitted file(s) to …\AUXREP\OC\OC_G\Sensitive\ in the Development environment. Create the folder if necessary.
                2. Mark the sensitivity in the Submission_Log's Status column using the web tool.

    3. Notify the Project Leader and Data Steward the file(s) were sequestered due to sensitivity.
    4. Terminate the process.
2. Mark the Status column in Submission_Log as certified (C) using the web tool; include date certified and initials of certifier.
3. Update the Development deliverable tracking spreadsheet with the date of certification for OC_G.
4. Copy the file(s) from the staging directory into …\AUXREP\OC\OC_G\ in the Development environment.
5. Establish and test web link(s) on the Development website's OC_main.aspx page.
6. Propagate the new and revised files from Development to Staging/integration environment.
7. Test and then propagate from Staging/integration to Production environment.
8. Verify deliverable(s) are accessible from Production website.
9. Update the Development deliverable tracking spreadsheet with dates for the OC_G's Repository and Dissemination milestones.
10. Create a PDF of all years from the latest tracking spreadsheet and propagate the PDF to Staging/integration and Production sites.

SOP 3: CON Calibration Files (OC_A Creation)

Summary

Be aware there are two different internal file types used by the Sea-Bird vendor to hold calibration information. The type having extension CON was used through 2013. Beginning in 2014, SEAN adopted the newer format having extension .XMLCON. The methods for using them are basically the same. For simplicity, the term CON is used when referring to either of these file types.

OC_A is built in one of two ways, depending on circumstances. Case one occurs when the Project Leader receives a vendor-supplied CD or DVD containing a CON file, typically after an annual full recalibration of all sensors. In this case, the CON file is packaged by the project leader, submitted through the Data Steward to The Data Manager for the validation and quality assurance process, and eventually certified.

Case two occurs when a single sensor undergoes recalibration (or initial installation). The sensor is shipped with paper documentation that must be used along with vendor software to create an updated CON file. In this case the project leader passes the new calibration parameters to the Data Steward, who creates a new CON file combining the new calibration data as well as the existing parameters for other sensors.

Regardless of which case necessitated creation of the deliverable, a common procedure is used for validating and disseminating the final product. It is possible for a year to contain multiple CON files. Also, the content of a CON file may span a year boundary: the year a CON file is named and accounted for is the latest year for any instrument calibration residing inside the file.

SOP 3 requires users to work in the internal NPS network under valid Active Directory accounts. Access questions should be directed to the Data Manager.

Detailed Steps

A. Case one: Full calibration file set is received

1. Project Leader tasks
    1. Receive CD/DVD supplied by vendor with recalibrated CTD.
    2. Open the CON file using the vendor’s SBEDataProcessing.exe tool, following these instructions:
        1. Start the SBEDataProc.exe program. It should be on the Project Leader’s computer under the “Start” button.
        2. Select “Configure” from the top menu. On the dropdown menu click on the subject CTD type, such as “SBE 19plus V2 Seacat CTD.” A Windows form will appear on screen.
        3. Press the OPEN button on the form. Navigate to the new copy of the CON file supplied by the vendor. Open it. The Windows form will now list the sensors defined in the latest CON file.
        4. Press the REPORT button to display the inner contents of the file.

3. Verify that the CON file calibration coefficients exactly match those given on the paper or PDF file versions. If discrepancies are found, use the software to make the CON file match the documents as described under case two.
4. Copy the CON file from CD to \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CON_calibration, where YYYY is the last year of calibration mentioned inside the file, e.g., 2009. The vendor's file is typically named on the CD using the format YYMM.CON (or, as of 2014, YYMM.XMLCON), where Y stands for year and M is month. In order to distinguish this calibration from those of any other CTDs employed, the filename must be changed. Rename the local copy to the form C_YYMM.CON, where C stands for CTD number. The YY and MM are taken from the ***last*** date of an instrument calibration in the file, which may or may not match the vendor's name. For example, a file whose last sensor was calibrated for CTD #5 on February 18, 2010 would be named 5_1002.CON. Also, multiple CON files may exist in this folder for other purposes than building an OC_A.
5. Notify the Data Steward a new deliverable OC_A is ready for validation, specifying the exact filename used.

2. Data Steward tasks
   1. Review that the filename of the OC_A is properly formed. This entails using SBEDataproc software to view the internal contents in order to ascertain the correct month and year. SBEDataproc is available in the Toolbox section of the website.
   2. Submit the GLBA-situated file via email attachment to the Data Manager for validation, specifying in the message body it is deliverable OC_A, as defined in protocol OC-2014.1.

B. Case two: Paper addendum to calibration is received

1. Project Leader tasks
   1. Create, validate, certify, and disseminate any additional OC_G calibration form image(s) deliverable.
   2. Notify the Data Steward of the specific new images that must be represented in a new CON file.
2. Data Steward tasks
   1. Make a new copy of the CON file that directly preceded this revision effort. Calibration files are located on \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CON_calibration\ where YYYY is the year of last calibration embedded in the CON file, e.g., 2009. Name the file C_YYMM.CON (or C_YYMM.XMLCON) where C is the CTD number and YYMM reflect the latest year and month for which calibration was done as depicted in the new paper addendum. In the unlikely event this name collides with an existing certified CON file, name it C_YYMMx.CON where *x* is a letter used to distinguish this latest update from its predecessor. Begin the sequence with "a" and use sequential letters for additional updates. For example, the first revision to original calibration file 1_0903.CON would be 1_0903a.CON. The next revision (which must be based on 1_0903a.CON) would be 1_0903b.CON.

2. Using the Sea-Bird program SBEDataProc.exe, revise the calibration parameters in the new CON file to exactly match the new information in the new OC_G, while not changing items that define other aspects of the CTD. Errors in the CON file will produce erroneous results in other deliverables, and the fact that results are incorrect may not be obvious.
    1. Start the SBEDataProc.exe program. It should be on the Data Steward's computer under the "Start" button.
    2. Select Configure from the top menu. On the dropdown menu, click on the subject CTD type, such as "SBE 19plus V2 Seacat CTD." A Windows form will appear on screen.
    3. Press the OPEN button on the form. Navigate to the new copy of the CON file made in the preceding step. Open it.
        1. The Windows form will now list the sensors defined in the latest CON file.
        2. If a new sensor is being added to the configuration, select its channel, press the SELECT button, highlight the new device in the list, and press OK.
    4. Double-click the name of the first sensor needing parameters adjusted. A dialog box will be displayed showing the latest calibration entry for that particular sensor. Each sensor takes different types of values. The calibration document should have values that match the dialog box entries for a particular sensor.
    5. Revise the screen entries so they match the corresponding new document.
    6. Press the OK button when the sensor has been fully defined.
    7. Back on the Windows form, press the SAVE button to permanently write the new information to the CON file.
    8. If there are additional sensor calibrations to enter, do this in the same manner as the first adjustment.
    9. When done, press the EXIT button and then close the SBEDataproc.exe application.
3. Submit the new file via email attachment to the Data Manager for validation, specifying in the message body it is deliverable OC_A, as defined in protocol OC-2014.1.

C. Regardless of which case

1. Data Manager tasks
    1. On receipt of the submission, assign the next formal submission number to this file, as found in the master Submission_Log table.
        1. Use the "Update Submission Log" web tool on the NPS network at http://sean-dm.glba.nps.gov/0_submission_update.aspx
        2. Complete Submission_Log details up through the Submission_Date column.
            1. Due to the nature of this deliverable, there is no submission unit scope. The filename is sufficient to distinguish it.
            2. It would aid future users if the submission unit is entered as a comment listing the CTD and year involved. Follow existing entries as examples.
    2. Save the email attachment in the staging area for validation at \\sean.glba.nps.gov\data\SEAN_Data\Staging\OC\OC_A\NNNN, where NNNN is the submission number assigned above.

    3. If this is the preseason calibration at the start of the cruise year, update the deliverable tracking spreadsheet row "Preseason calibration assessment" to reflect the date of the latest instrument calibration embedded in the CON file (viewed by using SBEDataProcessing.exe).
    4. If this is the postseason calibration after completion of the cruise year, update the deliverable tracking spreadsheet row "Postseason calibration assessment" to reflect the date of the latest instrument calibration embedded in the CON file (viewed by using SBEDataProcessing.exe).
    5. If this is the first OC_A submission for the calendar year indicated in the filename, update the deliverable tracking spreadsheet with the date of first submission under OC_A.
    6. Validate the submission according to current criteria.
        1. Criteria are minimal because this deliverable's form is proprietary to the CTD vendor.
        2. Ensure its name meets the standards defined in Appendix J.
        3. Record validation summary data in the Submission_Log using the web tool.
            1. Set status code to V if mandatory validation passed. Then update the deliverable tracking spreadsheet with the date of validation for OC_A.
            2. Set status code to F if mandatory validation failed.
    7. If submission fails mandatory criteria, reply to the original submission with a "failure email" that includes:
        1. The submission number assigned
        2. The deliverable ID
        3. The protocol ID
        4. Documentation listing all the specific mandatory criteria failed
    8. If submission passes mandatory criteria, reply to the original submission with a "success email" that includes:
        1. The submission number assigned
        2. The deliverable ID
        3. The protocol ID
        4. Documentation listing any specific optional criteria failed
        5. Request to certify deliverable as complete
2. Data Steward tasks
    1. On receipt of failure email:
        1. If failure is due to filenames, typos, or other readily correctible issue, perform correction and resubmit.
        2. If failure is due to other reasons, request Project Leader obtain corrected materials from the vendor. Then restart the process from the beginning.
    2. On receipt of a success email, confer with Project Leader regarding any failed optional criteria:

        1. If these are acceptable:
            1. Reply to both Project Leader and Data Manager with a “certification email,” stating the deliverable is certified and may be disseminated.
            2. Notify Project Leader to store related forms or CDs in a physical file at GLBA.
        2. If these are unacceptable:
            1. Reply to both Project Leader and Data Manager with a “withdrawal email,” stating the deliverable is withdrawn.
            2. Take remedial action to obtain a corrected deliverable.
            3. Restart the process from the beginning.
3. Data Manager tasks
    1. On receipt of a withdrawal email:
        1. Mark the withdrawal in the Submission_Log’s Status column using the web tool at http://sean-dm.glba.nps.gov/0_submission_update.aspx
        2. Terminate the process.
    2. On receipt of a certification email:
        1. Verify no sensitive information is in the deliverable. Products containing sensitive information cannot be disseminated. OC_A is never expected to be sensitive.
        2. If not sensitive, copy the submitted file in staging to the Development environment at …\AUXREP\OC\OC_A\.
        3. Update the Development deliverable tracking spreadsheet with the date of certification for OC_A.
        4. Establish/test web link(s) on the Development website’s OC_main.aspx page.
        5. Update the formal metadata XML file in Development so it includes the new date range.
        6. Propagate the new and revised files from Development to Staging/integration environment.
        7. Test and then propagate from Staging/integration to Production environment.
        8. Verify deliverable(s) are accessible from Production website.
        9. Update the Development deliverable tracking spreadsheet with dates for the Repository and Dissemination milestones.
        10. Create a PDF of all years from the latest tracking spreadsheet and propagate the PDF to Staging/integration and Production sites.

SOP 4: Hydrographic Survey

1 Field Preparations

Be aware that both a primary and a separate backup CTD are maintained, as explained in SOP 1. Under normal circumstances only the primary CTD is taken on a cruise. In case of equipment failure in the field, staff typically must return to port and prepare the backup instrument for completing the cruise. Before entering the field, staff should review the safety documentation in Appendix E.

1.1 Supplies to Have Available

Assemble these items: primary CTD; lowering line and hardware; distilled water and Triton X-100 solution containers; wash bottles for cleaning and rinsing the CTD; field log sheets (Appendix B); GPS; laptop computer with serial port adapter, data transmission cable, and appropriate Sea-Bird software; personal protective equipment (e.g., gloves, earmuffs); tool kit; general equipment spare parts kit; and this protocol document. Appendix C details specific equipment needed to complete oceanographic surveys. During transport, always ensure that the CTD is well secured; severe vibrations can result in broken connections or damaged sensors. Please treat the instrument carefully—it is very expensive. The CTD communications, battery, memory, and date/time checks can be done on board or in the office; in any case, make sure that all these checks have been performed prior to leaving the dock (see the following four steps).

1.2 Check Computer-to-CTD Communications

Before deploying the primary and backup CTDs for a particular cruise, check the status of the instruments using the Sea-Bird application SeaTerm.exe running on a laptop connected to each CTD with the proprietary data cable. This is best performed in the office immediately prior to loading the boat for a field survey. See details of communication and operation in SOP 5 and/or the SBE-19 operator's manual for help.

1.3 Check Battery Voltage

Check battery condition using the SeaTerm program. In the SeaTerm window, press F3 or click on the Connect button. If the "Vmain" value displayed is less than 11.5 volts, replace all nine D-cell batteries in that instrument.

1.4 Check Memory and Clear

Ensure that both CTD memories are empty (previous cast data was cleared after the last download to storage). When connected, the SeaTerm display should show cleared memory (nsamples = 0, memory = 0). If the memory still needs to be cleared, issue the InitLog command in SeaTerm. *Note that although CTD #5 (Sea-Bird 19-plus) has a very large memory, CTD #1 (Sea-Bird 19) has a relatively small memory (~43,300 "samples," or only 10 casts' worth of Glacier Bay station data). Consequently, it is imperative that all cast data from CTD #1 be copied and transferred every 10 casts or less so that the memory can be initialized back to zero (empty); otherwise, valuable data will be lost.*

1.5 Check Date and Time

Check to see that the time and date are current for Greenwich Mean Time (GMT). Note that GMT is either eight or nine hours away from Alaska local time, depending on whether daylight savings is in effect (eight hours when daylight savings is in effect; nine hours when it is not). If the CTDs are not synchronized to GMT, enter the “ST” command in SeaTerm. The program will prompt for the correct date, then the correct time. Synchronizing your watch with CTD time will help avoid mistakes when entering information in the Field Log (GMT can also be displayed on the GPS). It is important that GMT time be employed so that future analyses can accurately relate the timing of the tidal signal to the timing of the CTD cast. Tidal analyses are carried out with respect to GMT, so avoiding the use of local time will help avoid errors introduced by switching in and out of daylight savings.

1.6 Verify Vessel is Prepared

- Ensure the GPS used for the chosen vessel has the station coordinates recorded.
- Verify the vessel is fitted with a properly working power block and davit.
- After the instrument is loaded onto the vessel, be sure to secure the end of the cast line to the CTD using metal locking carabiner(s) or shackle (wired or cable-tied), with the opposite “bitter” end secured to the vessel.

1.7 Soak the Dry Conductivity Cell

When removed from storage, the dry conductivity cell needs to be hydrated before being deployed. Using the syringe/tubing assembly, fill the cell with 0.1% Triton X-100 solution for at least one hour. When ready to use, drain the Triton X-100 solution and rinse with fresh water. Do not allow Triton X-100 solution to flow through to the dissolved oxygen sensor, which may be adversely affected.

1.8 Confirm System Operability with the First Cast

After the first cast of each survey day, connect the CTD to the laptop with the proprietary data transmission cable. Download the first cast using the process explained in SOP 5. Visually inspect the data string for missing and/or unusual-looking “samples” or characters. Then plot the data to confirm that all sensors are working properly.

Plotting is accomplished by double-clicking the icon named either “#1_Hex_Plot in Field” (for CTD #1) or “#5_Hex_Plot in Field 2014 and later” (for CTD #5). You must provide the cruise year and the name of the CON file to use. The CON file must already be stored on the laptop in directory C:\oceanography\YYYY\CON_calibration\, where YYYY is the cruise year (see SOP 5). Also be sure there is a directory present named C:\oceanography*YYYY*\Plot\Hex\temp\; it need not contain any files, but it must exist. Typical invocation of the hex plot is shown in Figure SOP 4.1.

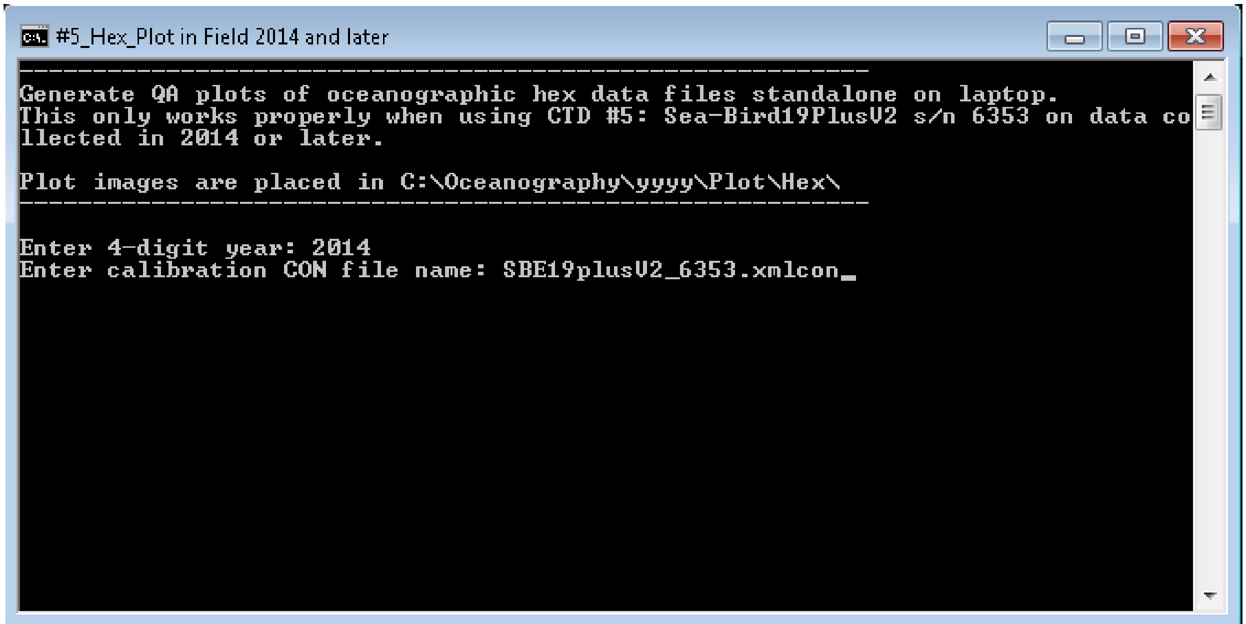


Figure SOP 4.1. Screen appearance when calling up a hex plot in the field.

Two plots are generated for every cast present on the laptop for the cruise year. They may be viewed using the Windows Explorer application. Scroll to the pair of JPG files that reflect the first cast of the day and double-click their names. If any signals appear abnormal, the equipment should be diagnosed for faults before performing additional casts.

2 Field Operations

2.1 Select Sampling Sequence

The Vessel Operator and Project Leader will work together to determine the order in which to occupy stations. Consideration for efficiency, personnel, and vessel and equipment safety should be taken into account when assessing weather conditions and the short-term forecast. It is desirable to occupy stations south of Station 04 on the incoming tide for data collection consistency purposes, but it is more important that all target stations are occupied.

2.2 Navigate to Station

The Vessel Operator will navigate to each station in turn using GPS navigation and ensure that the CTD cast is initiated within 200 m of the predefined station location.

2.3 Complete CTD Station Log

See Appendix A for a listing of the nominal station locations and depths. See Appendix B for a copy of the standard log form. At the start of a new field log sheet, fill out the top header information, including:

1. Vessel name
2. Cruise identifier (e.g., “March 2014”)
3. The CTD number employed (CTD number is local to the NPS SEAN system and defined in Appendix F)

4. The data dump number (sequential number for download. Check previous data dump log for current number to use. Also see Appendix B)
5. The names of observers responsible for conducting the CTD cast

At the beginning of the CTD cast, record on the field log sheet:

1. The sequential cast number (01, 02, 03, 04, …). Be aware that CTD #1 firmware starts numbering with cast 00, while CTD #5 starts numbering with cast 01.
2. The station identifier (01, 04, 07, …).
3. The latitude and longitude of the cast location, using decimal degrees in WGS 84 datum. (Alternatively, mark a waypoint on the GPS and record the waypoint number in the logbook. See Section 2.10, below.)
4. The GPS waypoint number for future reference on the cruise.
5. The date and time at the station. Record time as GMT date and time; note there are different offsets for Alaska Standard Time (add nine hours) and Alaska Daylight Savings Time (add eight hours).
6. The bottom depth as measured by the fathometer (or the previously known depth for that station if the fathometer is not operating reliably).
7. The target depth for the CTD (i.e., the amount of line to pay out).
8. Comments documenting any item of note associated with this cast. Use extra room on the bottom or the back of the field log sheet if needed.

2.4 Prepare the CTD

1. Remove the syringe assembly from the temperature/salinity intake duct fitting.
2. Remove the DO sensor closed tubing loop and securely reconnect the sensor to the in-line CTD tubing.
3. Remove any sensor protective caps (e.g., PAR sensor and fluorometer).
4. Check to make sure the dummy plug is securely attached to the end of the data transmission connection.

2.5 Initiate Data Logging

Slide the magnetic switch all the way to the "ON" position. See Figure SOP 4.2 for details of the CTD sensor layout and on/off switch location.

2.6 Equilibrate the CTD Just Below the Surface

Lower the CTD into the water, just below the surface, to equilibrate for a minimum of two minutes. Record the time "on" in the field log sheet. Employ a stopwatch with timer alarm to ensure a full 120-second soak period is observed. This equilibration time will allow 45 seconds for the pump to turn on, time for the instrument to adjust to ambient temperature, and time for the conductivity cell to flush. Be aware the data processing program is configured to remove the first 90 seconds of data collected from the time the switch is set to on, so short soaks will cause lost data points. During this two-minute soak period, fill out the rest of the information for that cast on the field log sheet (cast number, station number, latitude/longitude, waypoint, date and time, fathometer, and target depth).

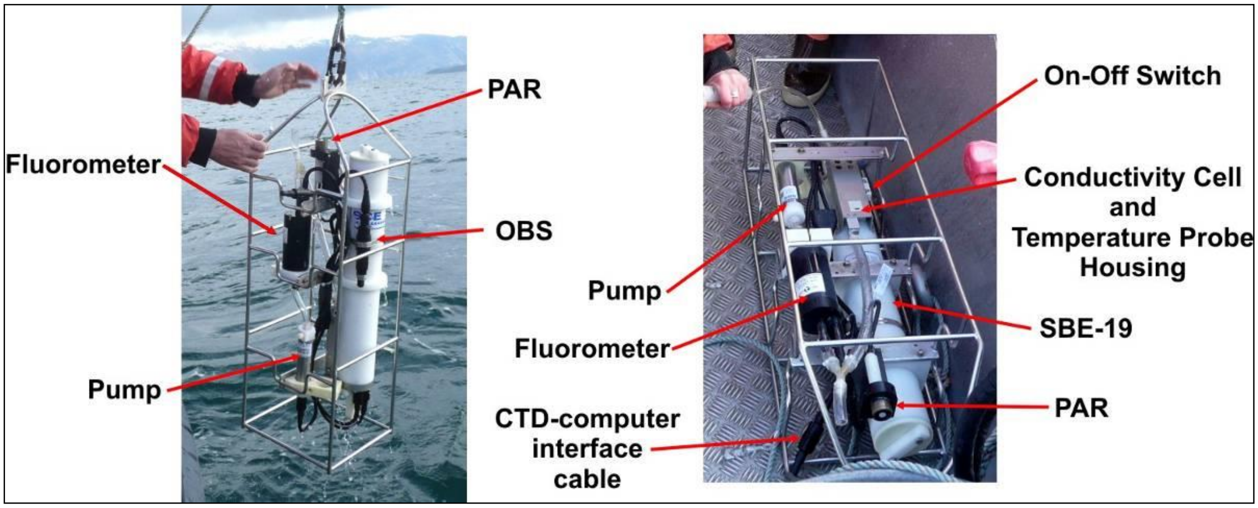


Figure SOP 4.2. Typical location of SBE-19 CTD sensors and on/off switch. CTD #1 is illustrated. Other CTDs may have somewhat different physical configurations.

2.7 Lower CTD to Target Depth

Lower the CTD using 3/8" nylon three-braid line marked at 10-m intervals. The lowering speed should be 30 m per minute (.5 m per second) for the uppermost 50 m and can be increased to 60 m per minute (1 m per second) below 50 m depth. This allows higher resolution (more data samples) for the upper portion of the water column that is most dynamic seasonally, most important to determining water column stability, and of greatest interest regarding primary productivity. Blue tape markers indicate 10-m intervals, red tape indicates 50-m intervals, and green tape indicates 100-m intervals. The instrument should be lowered to no more than 90% of the fathometer depth measured at the station or 10 m above the bottom, whichever is greatest, and never more than the rated maximum depth of 600 m. As a safety precaution, the CTD is never lowered to more than 550 m.

An experienced Project Leader is afforded some discretion with regard to the amount of line paid out in order to achieve the desired cast depth. This is quite straightforward in conditions of no wind or current (merely pay out an amount of line equal to the target depth); however, local conditions frequently cause the vessel and deployed CTD to drift away from each other, resulting in an apparent line angle (from vertical) at the surface, meaning the CTD will not reach the target depth. Based on experience, and using an abundance of caution, the Project Leader may release additional line in order to allow the CTD to more closely approach the station target depth.

2.8 Haul CTD Back to Surface

Retrieve the CTD with a power block/davit or a longline drum. Note that data are collected by the CTD on both the down- and up-casts. The up-cast data are not typically used for analysis (down-cast data are more accurate because the sensors are receiving and measuring a nearly undisturbed water column on the way down). However, occasionally up-cast data may need to be used if there are problems with the down-cast or its resulting data. CTD retrieval speeds are the same as for the down-cast: 1 m per second up to 50 m depth, then 0.5 m per second from there to the surface. Be careful as the instrument nears the surface, taking care to control the power block so the CTD is not jerked up out of the water and into the davit block or against the side of the boat (watch for the red warning tapes). Be particularly careful when swinging the instrument and davit over the rail and lowering the CTD onto the deck.

2.9 Terminate Data Logging

Turn the instrument off with the magnetic switch (slide all the way to the “OFF” position).

2.10 Complete CTD Station Log

Record any irregularities about the cast on the field log sheet. Include comments about such events as the magnetic switch arriving at the surface in the “OFF” position (forcing a repeat of that station’s cast), information about obvious surface conditions (turbidity, evidence of phytoplankton bloom), situations resulting in significant line angle and causing additional line to be added to achieve the target cast depth, etc. If you marked a GPS waypoint for the cast’s initial location and time, enter those coordinates onto the form now in case the waypoint is lost when others use the GPS later.

2.11 Triton X-100/Freshwater Rinse

Using the wash bottle, rinse the optical sensors (PAR, fluorometer) with distilled water. Flush the conductivity cell with Triton X-100 solution followed by distilled fresh water as explained in SOP 1. The syringe/tubing assembly should be left attached to the cell to avoid drying out between casts (except for in freezing weather: see SOP 1, Section 1.1).

2.12 Stow CTD for Transit

Secure the CTD for transit to the next station, using special care for rough sea conditions. When air temperature is greater than 5 ºC, the CTD may remain on deck. In freezing and near-freezing conditions, bring the CTD into the vessel cabin between stations and during transit to avoid freezing and damage to the conductivity cell.

2.13 Download CTD Data to Laptop

At the end of the day, download the CTD cast data to a local computer using the process described in SOP 5.

3 Postcruise Operations

3.1 Long-term Storage (Between Surveys) of the CTD and Associated Hardware and Spares

Stow CTD until the next field effort. For long-term storage procedures, see SOP 1.

For overnight short-term storage, the CTD may be left on board the survey vessel. Bring the CTD into the cabin to avoid freezing and damage to the conductivity cell.

3.2 Data Transfer to Network

After each cruise, transfer accumulated data from the laptop to the network according to details of SOP 5.

3.3 Plot Data

Once the cruise data have been transferred to the network, plot each cast for quality assurance purposes using SOP 7.

SOP 5: CTD Data Download and Transfer to Network

Summary

During a cruise, ideally at the end of each day, the contents of the CTD are downloaded to a laptop computer and given basic quality assurance tests. If significant problems are found during the quality assurance review, some stations may need to be reoccupied the following day in order to avoid loss of data. If problems are due to equipment fault, then the backup CTD has to be brought into service in order to finish the cruise.

After the data are transferred to the computer and a backup USB drive, the CTD memory is then erased to make room for additional data.

At the end of each cruise, the laptop files are copied to the park's network file server. These files are the basis for many other deliverables.

This process is the responsibility of the Project Leader.

Detailed steps

1. Before a cruise:
    1. Ensure the laptop has working copies of SeaTerm software.
        1. If not found on the laptop, seek Data Manager's assistance.
        2. In order to function, SeaTerm requires a serial port with DB-9 connector be present on the laptop.
    2. If this is the first cruise of the year:
        1. Create a "c:\oceanography\YYYY\HEX_raw\" folder on the laptop to hold the season's cruise data, where YYYY is the four-digit cruise year.
        2. Create a "c:\oceanography\YYYY\PLOT\temp\" folder on the laptop to support field-generated hex plots.
        3. Create a "c:\oceanography\YYYY\CON\" folder on the laptop to hold the latest CON files that are required to create field hex plots.
        4. Copy the latest CON calibration files for both the primary and backup CTDs from \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CON_calibration\ to c:\oceanography\YYYY\CON\.
    3. Ensure the serial data transmission cable is packed for the field.
    4. Determine the starting dump number for the cruise by incrementing the last dump number used by the OC survey program.
        1. It may be found on the most recently completed survey field log sheet from the prior cruise.
        2. **Only one sequential dump number is maintained for the monitoring program, regardless of how many CTDs are employed at various times.**
2. For each cruise day:
    1. Collect cast data using the method described in SOP 4.
    2. Retrieve daily data from CTD.
        1. Connect laptop serial port to CTD using proprietary data transmission cable.

2. Invoke SeaTerm software.
3. Be sure SeaTerm is set to download one specified cast at a time.
4. Press "connect" software icon.
    1. If it doesn't connect, take remedial action such as tightening cables and replacing batteries.
    2. If it does connect, the number of casts and the record numbers for each cast will be displayed.
        1. Complete a CTD Download Checklist (see Appendix B) from the displayed information; for date, use the local date transferred rather than the GMT collection date.
        2. If no processing is done on the CTD for 90 seconds, the connection is dropped to conserve battery power.
5. Invoke a data transfer using the "upload" button.
6. Specify the next cast to save, as tracked on the checklist.
7. You will be prompted for "header" information.
    1. Enter the values from the correct row of the field log sheet.
    2. Some entries play a critical role in subsequent processing and must match an exact format—do not add extraneous spaces or punctuation.
    3. Be mindful of the 90-second disconnect timeout.
8. Specify the destination file on the laptop as c:\oceanography\YYYY\HEX_raw\YYMM_C_DDDD_CC.HEX, where YY is year of cast, MM is month of cast, C is local CTD number (see Appendix F), DDDD is dump number, and CC is cast number. Zero fill any name component to ensure the filename is exactly 18 characters.
9. Watch screen progress to be sure the correct sample numbers are reflected for that cast and that no transmission errors are indicated. If the wrong records appear listed, delete the file using Windows Explorer and redo the download.
10. Mark the completed download on the paper checklist.
11. Repeat for each cast until the list is completely checked off.

3. Visually check basic quality of each HEX file.
    1. Locate each downloaded file with Windows Explorer and open it in NOTEPAD.
    2. The cast number should match the log sheet entry **and** the filename—this is **very important**!
    3. The header text should match the corresponding field log sheet values.
    4. Beyond the header, every line should be exactly the same length, with no gaps. Scan down to the end of the file for short or long lines. For one CTD/sensor configuration currently employed in the GLBA sampling, the line length is 24 characters, but the exact number of characters in the data line varies by the number and type of sensors on the CTD at the time it is used. What matters is they are all the same length.
4. If any file does not meet the quality assurance requirements, then delete it with Windows Explorer and recreate it with SeaTerm.
    1. A file cannot be deleted if it is still open in NOTEPAD. Close the file if necessary.
    2. The new file must go through this quality assurance as well.

        3. If a second attempt at downloading the cast also results in data lines that are not uniform in length:
            1. If logistics permit, perform a new cast for the problem station.
            2. Otherwise, use the NOTEPAD session to delete the invalid lines.
                1. Save the file and close NOTEPAD.
                2. Add a comment to the field log sheet specifying the number of invalid rows deleted due to length errors.
            3. If, from a particular point in time, files begin exhibiting consistently short or long lines, this suggests the CTD is faulty and must be serviced immediately.
                1. Loose or wet cable connections are a possible cause and field repairs may be possible.
                2. If field repairs do not resolve the issue, the backup CTD must be brought into service to complete the cruise.
    5. Verify header data.
        1. In Notepad, check all header information against that cast's data line in the original Field Log sheet; correct as necessary.
        2. Comments can be manually added by inserting a line beginning with two asterisks (**) after the "Cast Target Depth" line.
    6. Back up the current cruise's HEX files in the laptop folder to a USB drive.
        1. Plug in drive and wait for it to be recognized.
        2. Use Windows Explorer to copy all files from c:\oceanography\YYYY\.
        3. Use the "Safely remove hardware" function in the system tray to ensure the copy is complete.
        4. Physically remove the drive and store in a location separate from the laptop.
    7. Erase data from CTD.
        1. Verify that all casts have been downloaded to the laptop and backed up on the USB drive. If there is adequate memory (using CTD #5), this step can be delayed until data have been successfully transferred from the laptop to the network (see below).
        2. Using SeaTerm, enter the command "IL" and confirm the operation by entering "IL" a second time when prompted.
            1. This permanently erases all observations from the CTD memory.
            2. Do not use the "Init Log" button on the SeaTerm screen: it does not function properly with every CTD.
    8. Disconnect.
        1. Exit the SeaTerm program.
        2. Disconnect the cable from CTD and laptop.
        3. Securely replace the dummy plug on the CTD connection to the data transmission cable.
3. At end of each cruise:
    1. Copy the HEX files from laptop to the network server folder at \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\HEX_raw\ where YYYY is the survey year.

    1. Subsequent data processing will fail unless this specific folder holds all files for the cruise year.
    2. File names are critical for automated processing: they must exactly match the specified format.
2. Store the field log sheets in an annual paper file kept by the Project Leader.
    1. They will be required before the next cruise to determine the next starting dump number.
    2. They will be required postseason to generate OC_H field log images.
    3. They will be required postseason to generate OC_M data quality assessments.

SOP 6: Raw HEX Files (OC_B Creation)

Summary

During a cruise, at the end of each day data from each cast recorded on the CTD must be moved to a laptop computer file. The laptop files then undergo basic quality assurance. When the laptop files are judged usable, the CTD memory is erased to make room for the next collection of data.

At the end of each cruise, the Project Leader copies the collected laptop files to a specific location on the park's network file server.

At the end of each season, the Data Steward zips the network file copies into one file for the year. He submits the one file to the Data Manager as OC_B. Validation and quality assurance iterations are performed until the Project Leader and Data Steward are satisfied the data are as accurate and complete as is practical. The Project Leader certifies the deliverable and the Data Manager arranges for repository and dissemination.

SOP 6 requires users to work in the internal NPS network under valid Active Directory accounts. Access questions should be directed to the Data Manager.

Detailed steps

A. Project Leader tasks

1. During the field season, the data capture procedures described in SOP 5 must be successfully completed. They provide the required basis for performing this SOP.
2. After the season is over and all captured data have been placed in the proper network directory, notify the Data Steward that OC_B is ready to process.

B. Data Steward tasks

1. Verify all of the year's cruises are present as hex files in \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\HEX_raw\.
    1. If any hex files are missing and cannot be located, this should be marked on the original field log sheet before it is scanned and preserved. That information will be needed when building the OC_M quality assessment and OC_K annual report at the end of the cruise season.
    2. If multiple CTDs were used in a cruise year, then quality control tasks will require the …\HEX_raw\ folder to have each CTD hex file set be moved into it for processing and then moved out. When generating OC_B, the combined set of all hex files for the cruise year must be copied into …\HEX_raw\.
2. Zip all the hex files in …\HEX_raw\ into a single file stored in that same folder using Windows Explorer and Winzip or similar application.
    1. The filename form should be HEX_YYYY_a.ZIP, where YYYY is the cruise year and "a" is *A* for the first submission, *B* for the second, etc.
3. Submit the deliverable file by sending an email notification to the Data Manager for validation.
    1. Do not attach the ZIP file to the email, as it may be too large to be delivered.

2. Specify in the message body that it is deliverable OC_B, as defined in protocol OC-2014.1.
3. Specify the fully qualified filename that the ZIP resides in.
4. Do not alter the deliverable file after the submission email has been sent; that could break the validation process.

C. Data Manager tasks

1. On receipt of the submission, assign the next formal submission number to this file using the "Update Submission Log" tool on the NPS network at http://sean-dm.glba.nps.gov/0_submission_update.aspx.
2. Complete Submission_Log details up through the Submission_Date column, entering the submission scope as the four-digit cruise year.
3. If this is the first OC_B submission for the cruise year, update the deliverable tracking spreadsheet in Development with the date of first submission under OC_B.
4. Copy the zip file into the staging area for validation at \\sean.glba.nps.gov\data\SEAN_Data\Staging\OC\OC_B.
    1. Put it in its own subdirectory whose name is the same as the submission number.
    2. Ensure its name meets the standards defined in Appendix J.
5. Unzip the file into its component HEX files in the staging area.
6. Invoke validation of the HEX files according to current criteria by using the web program at http://sean-dm.glba.nps.gov/OC_DM_validate_OCB.aspx.
    1. See Appendix J for detailed validation criteria.
    2. A findings file is produced in the same directory as the data detailing validation faults.
    3. Validation status is automatically recorded in the Submission_Log.
7. If submission fails mandatory criteria, reply with a "failure email" that includes:
    1. The submission number assigned
    2. The deliverable ID
    3. The protocol ID
    4. A specific list of all the mandatory criteria failed: attach the "findings.htm" file that was automatically created in the staging subdirectory.
8. If submission passes mandatory criteria, reply with a "success email" that includes:
    1. The submission number assigned
    2. The deliverable ID
    3. The protocol ID
    4. Documentation listing any specific optional criteria failed (attach findings file)
    5. Request to certify deliverable as complete, or withdraw

D. Data Steward tasks

1. On receipt of a failure email:
    1. Make corrections so the deliverable meets mandatory criteria.
        1. Print out the findings from the email if desired for ready reference.
        2. Expect most of the errors to be related to manually entered header information in the individual files.

        3. It may be convenient to have the scanned field log sheets (OC_H) accessible in order to help resolve exceptions.
        4. Edit each original HEX file using WordPad.
            1. Be aware these are the original source records and editing must be done with care to avoid introducing new errors.
            2. When a file is corrected, save it on top of the existing file.
        5. If a file cannot be made to comply with mandatory criteria (e.g., required head information is unknown), then rename the file with a .BAD extension to exclude it from the processing stream. If possible, also note the specific problem on the OC_H log form, which will inform the OC_M process.
    2. In case of accident, files may be restored to original state by obtaining a copy of previous submission from the Data Manager.
    3. Restart the process from the beginning by initiating a new submission with the corrected files.
2. On receipt of a success email, confer with Project Leader regarding any failed optional criteria:
    1. If these are acceptable reply to both project leader and data manager with a “certification email” stating the deliverable is certified and may be disseminated.
    2. If these are unacceptable:
        1. Reply to both project leader and data manager with a “withdrawal email,” stating the deliverable is withdrawn.
        2. Take remedial action to obtain a corrected deliverable.
        3. Restart the process from the beginning.

E. Data manager tasks

1. On receipt of a withdrawal email:
    1. Mark the withdrawal in the Submission_Log’s Status column using the web tool.
    2. Terminate the process.
2. On receipt of a certification email:
    1. If sensitive information is in the deliverable:
        1. Products containing sensitive information cannot be disseminated.
        2. Flag the Submission_Log’s Status column as Sensitive using the web tool.
        3. Copy the submitted single zip file to Development environment as …\AUXREP\OC\OC_B\SENSITIVE\HEX_YYYY.zip (no version letter in name). Create the folder if necessary.
        4. Propagate Development to Staging/Integration but NOT to Production.
        5. Notify the project leader and data steward the file(s) were sequestered due to sensitivity.
        6. Terminate the process.
    2. Give the Submission_Log Status column to “C” using the web tool. Put in the Date Certified and Certified By values.

3. Copy the HEX_YYYY.zip file from staging to the Development environment as …\AUXREP\OC\OC_B\HEX_YYYY.zip. Note no letter follows the YYYY in the certified file.
4. Establish and test web link(s) on the Development website's OC_main.aspx page.
5. Update the formal metadata XML file in Development so it includes the new date range.
6. Propagate the new and revised files from Development to Staging/integration environment.
7. Test and then propagate from Staging/integration to Production environment.
8. Verify deliverable(s) are accessible from Production website.
9. Update the Development deliverable tracking spreadsheet with dates for the Repository and Dissemination milestones.
10. Create a PDF of all years from the latest tracking spreadsheet and propagate the PDF to Staging/integration and Production sites.
11. Be sure to retain the individual files in the staging area.
    1. They will serve as file backup for the original CTD data.
    2. The original CTD files on the park server are typically directly edited in the validation process, so the staged versions are important as backup.

SOP 7: Postcruise Quality Assurance: Raw Data Plots

Summary

As soon as cruise data become available on the park network after completion of SOP 5, the performance of the CTD is reviewed by generating a set of profile plots from all of the HEX files. Sea-Bird SBEDataproc.exe software is used. Due to the number of parameters recorded, each cast requires two JPEG file plots in order to display all values.

It is important to perform this procedure immediately after each cruise, so the leader can detect faulty performance of individual sensors in time to complete repairs before the next cruise. (This quality check does not, however, replace the visual file inspections performed in SOP 5. Incorrect length data lines detected in SOP 5 typically indicate defects in the CTD hardware, firmware, and/or configuration but not in individual sensors.)

This process is the responsibility of the project leader. The plots are intermediate products local to the park and are not a formal SEAN deliverable. They are, however, required so the project leader may create the OC_M data quality evaluation deliverable at season's end.

If multiple CTDs were used during a cruise year (or one CTD was reconfigured during the year), this process must be run once for each CTD file set. Because calibration files are specific to a particular CTD and instrument set, the hex files must be segregated in order to be associated with their one proper calibration file.

Note: before executing this procedure, it may be helpful to review Appendix H regarding standard directory structures and Appendix I regarding Sea-Bird software layout.

SOP 7 requires users to work in the internal NPS network under valid Active Directory accounts. Access questions should be directed to the data manager.

Detailed Steps

A. Be aware of limitations inherent in software.

1. This process may be performed at the park or at any location physically connected to the NPS network.
    1. If executed outside the immediate park, it may take a great deal of time to complete due to GLBA's very slow network connection combined with the large amount of data involved.
    2. Be aware execution from outside could also slow Internet response to all park staff as the bandwidth saturates.
    3. If this must be performed outside the park, it is best done via remote desktop connection to a suitably configured computer physically located in the park.
2. The workstation used must have special SBEDATAPROC.EXE software and custom scripts installed.
    1. The custom scripts are required to automate a complex set of data processing steps.
    2. If not found on the Windows desktop, seek Data Manager's assistance.

    3. There are separate scripts for different CTDs, as well as for the same CTD that has had a significant change to its instrument configuration.
3. The software may present message boxes and halt until the operator issues commands to continue.
    1. Sometimes these messages do not appear in the foreground of the desktop but are hidden behind other windows.
    2. To limit hidden windows, it is advisable not to work with other software, such as web browsers, while this process is being performed.
4. The vendor software does not permit rigorous exception recovery.
    1. The applications may fail due to a number of circumstances.
    2. Familiarity with the Sea-Bird data processing applications will aid in diagnosing and overcoming problems.
    3. As of this writing, the authoritative manual may be found at http://www.seabird.com/pdf_documents/manuals/SBEDataProcessing_7.23.2.pdf .
    4. The Data Manager is available to assist in resolving software issues.

B. Be certain appropriate CON file(s) are present in the cruise year's folder.

1. The folder is \\files.glba.nps.gov\science\data\oceanography\data\YYYY\CON_calibration\
2. It is desirable, but not essential, that the CON files used here be certified OC_A products (SOP 3).
3. If there are multiple CTD configurations used within one cruise year, a separate CON file for each configuration needs to be in place.
4. The particular CON file to use for a particular CTD configuration is the one whose internal content is consistent with all the sensors for the CTD and is the most recently created one prior to the cruise. See SOP 3 and Appendix J for details regarding how to interpret the internal content of CON files.
5. The CON_calibration folder may have additional CON files present for other purposes. Do not delete any CON files.

C. Be certain the HEX cast data files from the most recent cruise are present.

1. They must be in \\files.glba.nps.gov\science\data\oceanography\data\YYYY\hex_raw\, where YYYY is the year of interest.
2. Be sure there are no empty HEX files, as explained below, in the directory named \\files.glba.nps.gov\science\data\oceanography\data\YYYY\HEX_raw\. Empty HEX files will halt the automated processing.
    1. Use Windows Explorer to find any files that are too small to contain data points.
    2. Navigate to \\files.glba.nps.gov\science\data\oceanography\data\YYYY\hex_raw\, where YYYY is the year of interest.
    3. Locate any file whose size is 2 KB or smaller.
    4. Open each small file with NOTEPAD.EXE or similar program to verify whether rows of hex data follow the line containing *END*.
    5. For each file with no data, use Windows Explorer to rename it by appending a ".BAD" extension.
        1. E.g., rename a file called 0903_1_0178_00.HEX to 0903_1_0178_00.HEX.BAD.

        2. This will effectively hide it from plot processing.

D. Generate plots from all HEX files

1. Verify the required directory structure is established for the year. There must be a \\files.glba.nps.gov\science\data\oceanography\data\YYYY\plot\HEX\temp directory available to generate work files in. Create it if necessary.
2. Be sure the ...\HEX_raw\ folder contains files from no more than one CTD configuration.
    1. Plots will reflect all hex files in the folder processed using a single specified calibration file.
    2. The calibration file specified must be appropriate to the CTD used.
    3. If multiple CTD configurations were employed, this plot generation function must be performed separately for each CTD, and the …\HEX_raw\ directory must have only a single CTD’s files copied into it during each iteration.
        1. Accomplish this by moving the HEX files irrelevant to processing against a particular CON file out to a temporary folder.
        2. Never delete any HEX files! These are the only copies of original data and may not be recoverable if deleted.
        3. After iterating through the multiple CTD configurations, be sure all the original HEX files are back in the \\files.glba.nps.gov\science\data\oceanography\data\YYYY\hex_raw\ folder
3. Be sure the directory \\files.glba.nps.gov\science\Data\Oceanography\Data\YYYY\Plot\HEX\temp\ has no files in it. Existing files from a different CTD may confuse the plotting software. Use Windows Explorer to delete any files that may be left over from earlier operations.
4. Invoke the automation scripts by double-clicking the provided desktop icon or, if no icon is available, by double-clicking its BAT file in Windows Explorer.
    1. Each CTD configuration has its own version of the script. For example, CTD 1 uses C:\Program Files\Sea-Bird\#1HEX_Plot.BAT. CTD 5 uses C:\Program Files\Sea-Bird\#5HEX_Plot.BAT (Figure SOP 7.1).

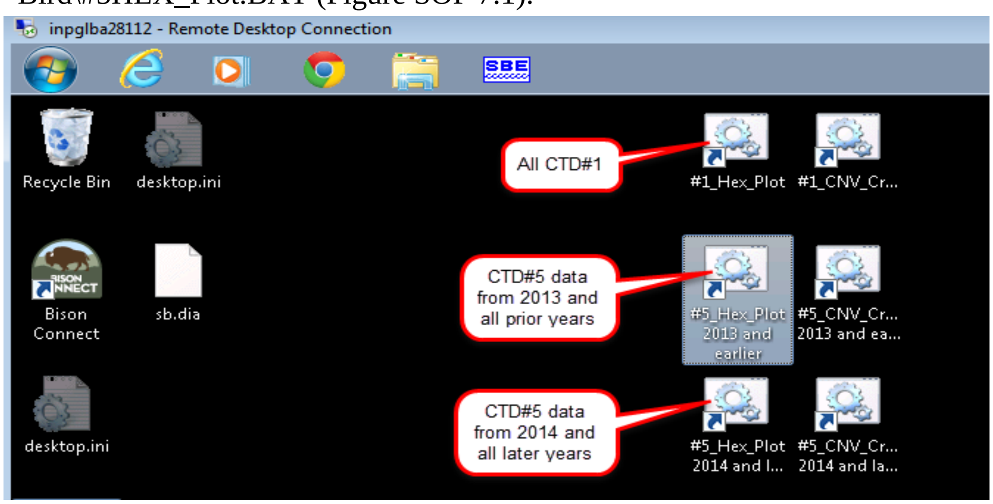


Figure SOP 7.1. In order to successfully plot raw data, one must invoke the application appropriate to the particular CTD configuration used.

    2. Details of program configuration are provided in Appendix I.
5. A DOS command window will appear and prompt the user for parameters.
    1. Provide the four-digit cruise year in response to the prompt.
    2. Enter the name of the calibration file to use.
        1. Generally, this is the file most current at the beginning of the survey year.
        2. Enter the filename and extension only.
            1. For example, 1_0436a.CON
            2. Do not attempt to specify any directory information. The locations of calibration files for each year are predefined.
            3. The file form to use up through 2013 is the CON file.
            4. Beginning in 2014, Sea-Bird XMLCON format files should be used.
    3. The process may appear unresponsive, with no visible indication of activity, but it is running. Be patient.
6. A Windows dialog box will appear titled “Data Conversion.”
    1. It shows parameters used and provides the status of file processing.
    2. As long as file processing progress is shown, nothing should be touched in the dialog box.
    3. Message boxes indicating errors in a particular file may appear.
        1. The messages are terse but do explain the nature of problems.
        2. Generally, they can be dismissed by pressing the OK button.
        3. If presented with a message box asking “Do you want to process the next file?”, one may generally press “YES.” A few defective files should not be grounds for cancelling all plots.
        4. If presented with the message “Output file already exists,” click on the “Yes to all” button.
    4. It will be over when the dialog box disappears.
7. Nothing will appear for a while, but the first set of plots, the “A” group, is being assembled.
    1. Once the software has looked at every HEX file for the year, it may display a message box warning of errors in certain files.
        1. Files exhibiting errors will not be plotted.
        2. Press the OK button on the message box to continue.
        3. Be aware this box may be hidden beneath other windows and that processing will not resume until OK is pressed.
    2. A Windows form titled “Sea Plot” will eventually appear.
        1. It should display a progress bar as it plots each file.
        2. One may monitor the creation of JPG plot files by watching files get added to the …YYYY\plot\hex\ directory (Figure SOP 7.2):

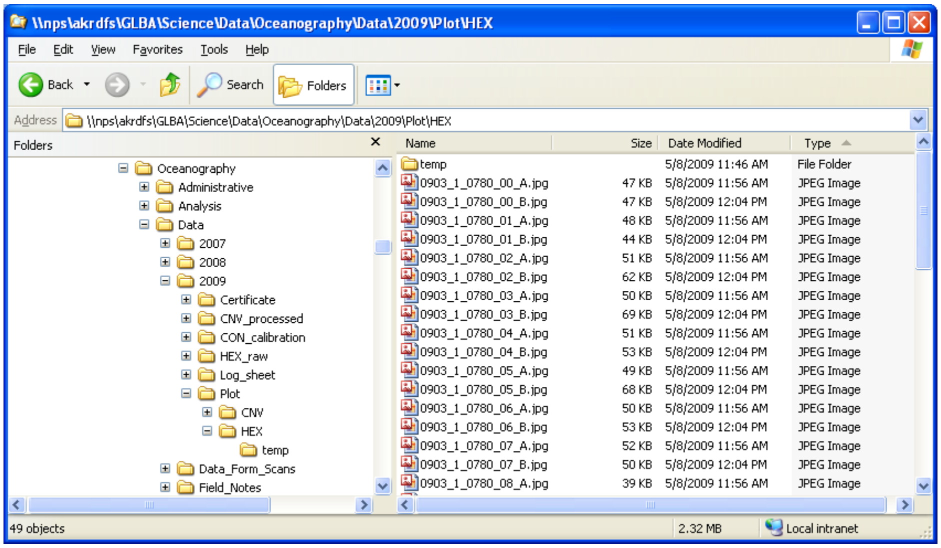


Figure SOP 7.2. Using Windows Explorer to monitor plotting progress.

3. When complete, the software may display a temporary plot viewing window, which should be dismissed.
4. Once the A plot files are complete, the dialog box will disappear.

8. Nothing will appear again for a while, but the second set of plots, the B group, is being assembled.
    1. The considerations and actions are the same as those in the previous step.
    2. After the B plots complete, the original command box should automatically disappear as well. If it doesn't, type "EXIT" in that box to dismiss it.

E. Review plots for indications of problems.

1. They may typically be viewed in Windows Explorer by double-clicking on a JPG filename in \\files.glba.nps.gov\science\Data\Oceanography\Data\YYYY\Plot\HEX. The application that pops up showing the first file typically supports scrolling through the other files in the directory. Figure SOP 7.3 illustrates this.
2. The plot files follow the same file naming convention as the HEX files, but have an _A or _B appended, indicating which parameter set they show.
3. Audit the count of plot files. Missing plot files are usually the result of damaged corresponding HEX files, which should be investigated.
4. Erratic plots of only one parameter suggest a faulty sensor in need of correction. However, outlier values only at the top of the cast are to be expected, as the CTD may start recording before being fully submerged and acclimated (Figure SOP 7.4).
5. Unexpected plots of multiple parameters, particularly if they occur on multiple casts from a particular time forward, suggest a systemic CTD failure (Figure SOP 7.5).
6. Operational error may also result in unusable readings (Figure SOP 7.6).

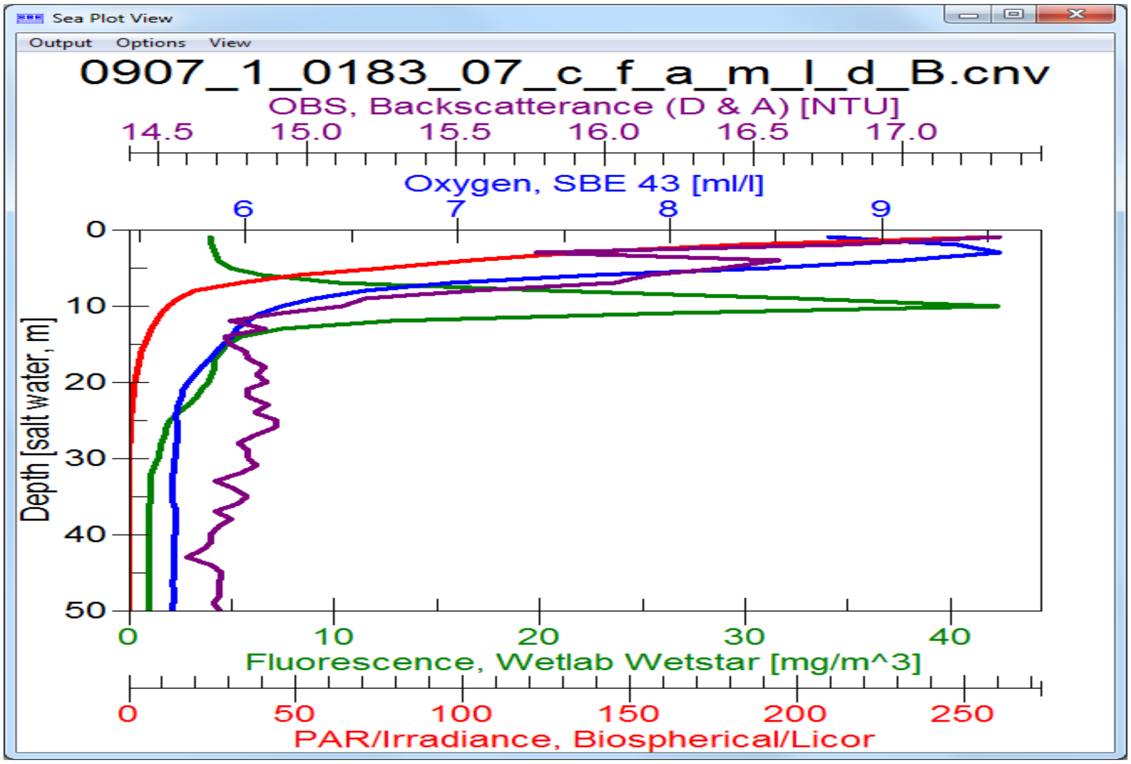
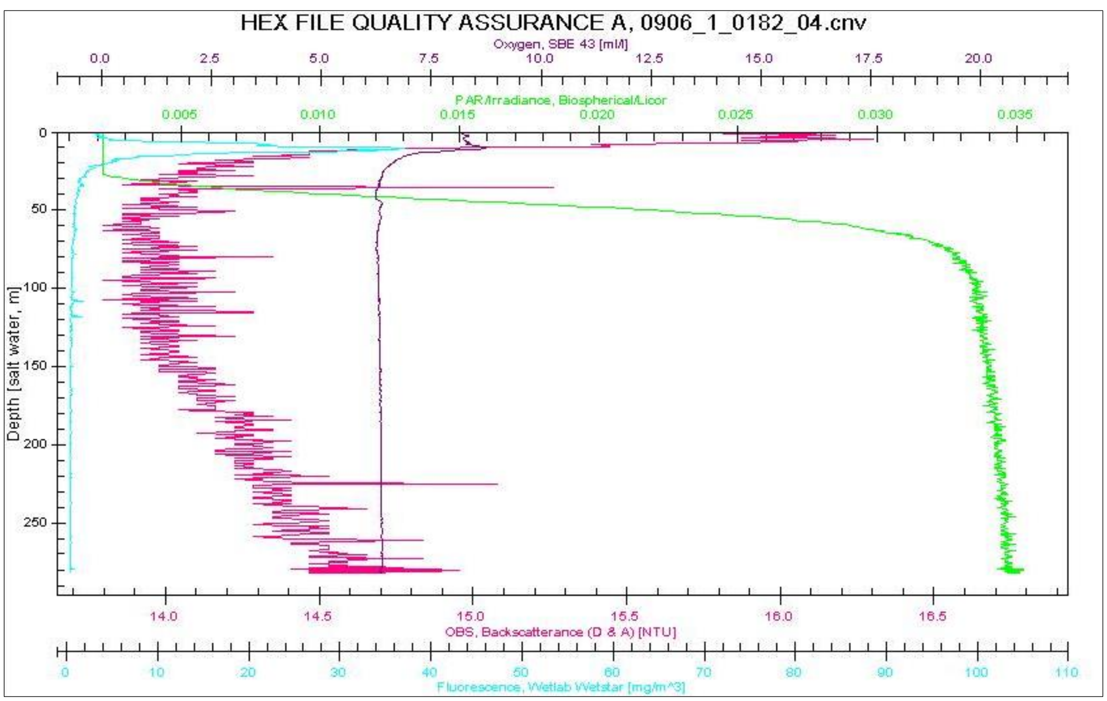


Figure SOP 7.3. Normal vertical profile plot of density, OBS, fluorescence and PAR.



SOP 7.4. Raw data profile plot illustrating an example of one faulty sensor. The PAR signal, measuring light intensity, should not be increasing with depth. A defective connector was the cause of this aberration. The cruise's subsequent casts were similarly flawed. Postcruise analysis of the HEX plots alerted the project that instrument repairs were required.

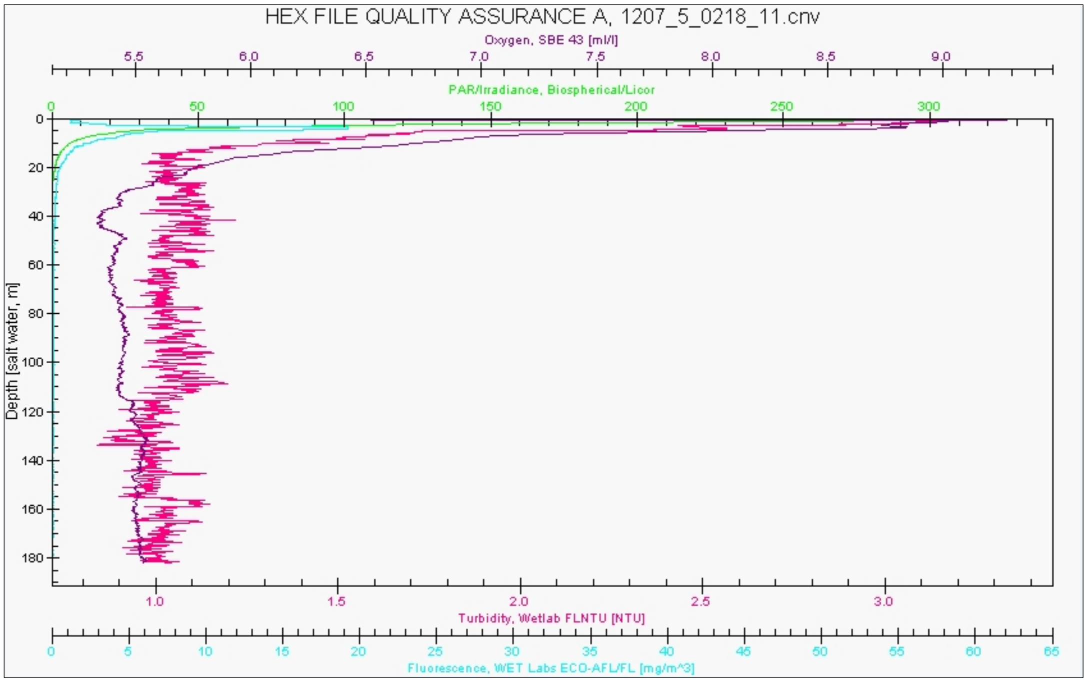


Figure SOP 7.5. Raw data profile exhibiting unexpected values. Cause was determined to be failing batteries affecting the entire CTD.

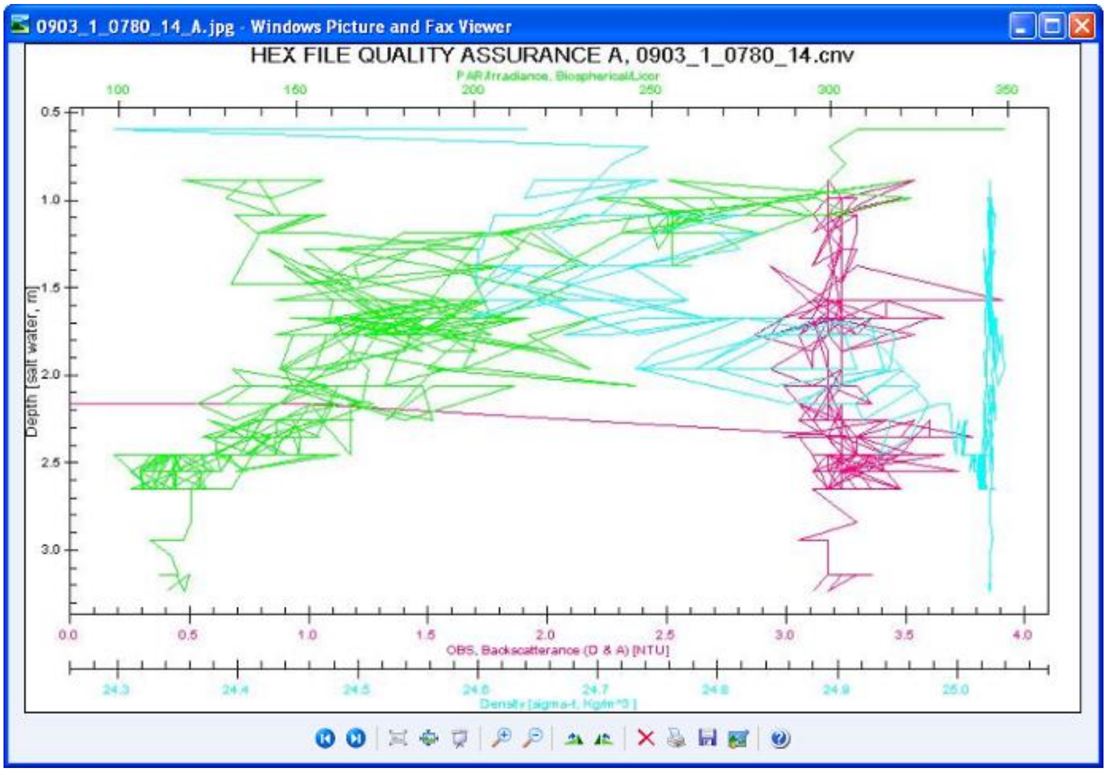


Figure **SOP 7.6.** Raw data profile plot illustrating a bad cast. In this case, the CTD only recorded the top 3 m of the column. Data show the measurements “settling” as the pump comes on and the data values approach steady readings during the soak period.

F. Retain the plot files for year end.

1. They will be required for determining data quality when deliverable OC_M is built at the end of the cruise year.
2. If accidentally deleted, they will be recreated the next time this process is run after another cruise. The automated process always plots all HEX files in the year's folder for a particular CTD configuration.
3. The …/YYYY/Plot/HEX/temp directory is used to store intermediate files integral to this process.
    1. These files are not intended to be used for any other purpose.
    2. They are not managed as formal deliverables and should be considered ephemeral.

SOP 8: Processed CNV Files (OC_C Creation)

Summary

At the end of the survey season, the certified HEX files along with the appropriate CON file(s) for the cruise year are retrieved from the SEAN website and copied to the work zone on the park file server. Sea-Bird SBEDataproc.exe software is executed under script control, creating the CNV files.

Once created, the individual CNV files are zipped into one file for the year. The Data Steward submits the one file to the Data Manager as OC_C. Validation and quality assurance iterations are performed until the Data Steward is satisfied the data are as accurate and complete as is practical. The Data Steward, in consultation with the Project Leader, certifies the deliverable and the Data Manager arranges for repository and dissemination.

Two profile plots of each fully processed CNV file are also generated by the SBEDataproc scripts. The project leader retains the plots to inform later creation of deliverable OC_M, Data Evaluation.

If multiple CTDs were employed during a cruise year, CNV processing must be performed separately for each CTD by moving each set of HEX files into the \HEX_raw\ folder separately and running the process against it with the proper calibration file. This also applies if one CTD is represented by two or more CON files in a cruise year (as, say, when an instrument is replaced midseason).

Note: before executing this procedure, it may be helpful to review protocol Appendix H regarding standard directory structures and Appendix I regarding Sea-Bird software layout.

SOP 8 requires users to work in the internal NPS network under valid Active Directory accounts. Access questions should be directed to the Data Manager.

Detailed Steps

A. Data Steward Tasks

1. Because most data files are stored on the park server, it is much faster to perform these tasks from the park than over the wide area network (WAN). In lieu of working within the park, a remote user might wish to employ terminal services on a computer located in the park.
2. Obtain the latest certified HEX files.
    1. Be absolutely certain the OC_B for the year has been completed through certification and dissemination; this process temporarily erases original raw data from the file server and requires a certified web copy of OC_B in order to restore it.
    2. Rename directory \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\HEX_raw\ to \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\$HEX_raw\ in order to sideline any existing OC_B.
    3. Download the certified OC_B deliverable from website http://science.nature.nps.gov/im/units/sean/OC_Main.aspx to the park file server directory \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\HEX_raw\.

    4. Unzip its files using Windows Explorer and Winzip or similar application. It could take a while to extract the files that comprise a year.
    5. Only one CTD may be processed at a time. If multiple CTDs (or one CTD having multiple CON files) were used during a cruise year, then delete all downloaded files from \HEX_raw\ except those for one CTD/CON combination. Ensure the needed OC_A CON files have been downloaded to the work zone for the target year. The other CTD(s) must have their CNVs created in separate iterations of this procedure.
3. Obtain the most recent certified CON file(s) for the season.
    1. Be absolutely certain the OC_A for the time immediately preceding the cruise has been completed through certification and dissemination; this process erases original raw data from the file server and replaces them with the certified files.
    2. Be aware the CON_Calibration folder for the year is used for several purposes and may contain more files than the one you need for this particular process. Also note that multiple CON files created from several years may be present in the same folder.
    3. Delete any file of the same name as the certified OC_A in \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CON_Calibration\.
    4. Download the most recent certified OC_A deliverable for the year to \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CON_Calibration\. The appropriate file is the most recent one for the CTD in use, which internally contains sensor calibration records all dated before the start of the cruise.
    5. If the configuration or calibration of a CTD was updated during the season, an additional CON file that matches each revised configuration must also be downloaded.
4. Using Windows Explorer, create a folder if necessary for the CNV output at \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CNV_processed where YYYY is the cruise year surveyed.
    1. Within that folder, create a subdirectory named “temp” if not already present.
    2. If the CNV_Processed folder already exists from an earlier failed attempt at creating OC_C, delete all its existing files, including those in the temp directory, using Windows Explorer. If CNV_processed already contains files from an iteration of this process for another CTD/CON combination used in the current cruise year, then leave those files in place.
5. Use SBEDataproc.exe to generate one CNV file from each HEX file.
    1. Be aware of inherent software limitations as detailed in SOP 7.
    2. The final output CNV files will be directed to \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CNV_processed\.
    3. Each file will be named YYMM_C_DDDD_cc_suffix.CNV
        1. YY is year, MM is month, C is CTD#, DDDD is dump number, and cc is cast number.
        2. Suffix refers to a set of single letters separated by underscores that get generated as a byproduct of the software process. A typical suffix is “c_f_a_m_l_d_b.”

4. Invoke the previously installed automation scripts by double-clicking the provided desktop icon or, if no icon is available, double-clicking its BAT file in Windows Explorer.
    1. Each CTD has its own version of the script. For example, CTD #1 uses C:\Program Files\Sea-Bird\#1CNV_Create.bat. CTD #5 uses C:\Program Files\Sea-Bird\#5CNV_Create.bat. If a CTD has its sensor configuration revised, the new configuration may also need its own script.

If the scripts are not available on the workstations employed (Figure 8.1), contact the Data Manager to have them installed.

Details of program configuration are provided in Appendix I.

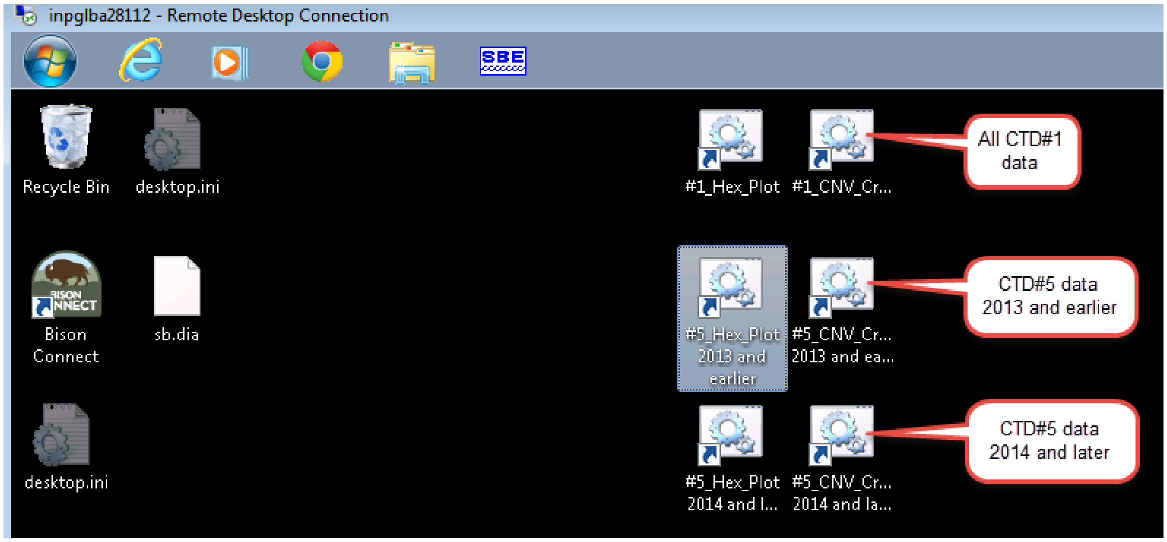


Figure SOP 8.1. The application used to generate CNV files must match the CTD configuration used.

5. A DOS command window will appear and prompt the user for parameters.
    1. Provide the four-digit year in response to the prompt.
    2. Enter the name of the calibration file to use.
        1. Generally, this is the file most current at the beginning of the survey year.
        2. Enter the filename and extension only.
            3. For example, 1_0436a.con
            4. Do not attempt to specify any directory information. The locations of calibration files for each year are predefined.
6. While nothing may appear to be happening, processes are starting in the background. Each one may take several minutes to appear on the screen. Be patient.
7. A Windows dialog box will appear titled “Data Conversion.”
    1. It shows parameters used and provides the status of file processing.
    2. As long as file processing progress is shown, nothing should be touched in the dialog box.
    3. Message boxes indicating errors in a particular file may appear.
        1. The messages are terse but do explain the nature of problems.

         2. Generally, they can be dismissed by pressing the OK button.
         3. If presented with a message box asking “Do you want to process the next file?”, one may generally press YES.
            1. A few defective files should not be grounds for cancelling the deliverable.
            2. Discuss any concerns with the Data Manager.
      4. This “Data Conversion” subprocess will be over when its dialog box disappears.
   8. Dialog boxes will similarly appear and disappear as the following additional processes execute: Filter, Align CTD, Cell Thermal Mass, Loop Edit, Derive, Bin Average, Sea Plot ‘A’ series, Sea Plot ‘B’ series.
      1. Note and dismiss any warning messages as they appear.
      2. Errors serious enough to halt the process are possible.
         1. Appendix I provides details helpful in diagnosis.
         2. The latest Sea-Bird software manual may explain how to recover.
         3. The Data Manager may be able to assist.
   9. Once the whole process completes, several sets of files will be created.
      1. \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CNV_processed\ will contain the final CNV files to be used in assembling OC_C.
      2. \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\Plot\CNV\ will contain a pair of plots for each cast.
         1. These are drawn from the fully processed CNV files.
         2. They should be similar but not identical to the quality assurance plots in the …\Plot\HEX\ subdirectory.
      3. \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CNV_processed\temp\ will contain the intermediate files left by each subprocess.
         1. These are left behind for diagnostic purposes.
         2. They are not to be reported to SEAN.
         3. They may be deleted once the associated OC_C is successfully certified.
6. Zip all the CNV files in \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\CNV_processed\ into a single file stored in the same folder.
   1. Use Winzip or a similar application.
   2. Name the archive file CNV_YYYY_a.zip.
      1. YYYY is the calendar year.
      2. Sequence letter “a” is A for first attempt, B for second, etc.
      3. For example, the second attempt at creating a valid 2012 OC_C deliverable would use filename CNV_2012_B.ZIP.
7. Submit the deliverable file via email notification to the Data Manager for validation.
   1. Specify in the message body it is deliverable OC_C, as defined in protocol OC-2014.1.
   2. Specify the fully qualified filename that the ZIP resides in.
   3. Do not attach the ZIP file to the email, as it may be too large to be delivered.
   4. Do not alter the deliverable file after the submission email has been sent; that could break the validation process.

B. Data Manager tasks

1. On receipt of the submission, assign the next formal submission number to this file, as found in the master Submission_Log table.
   1. Use the "Update Submission Log" web tool on the NPS network at http://sean-dm.glba.nps.gov/0_submission_update.aspx.
   2. Complete Submission_Log details up through the Submission_Date column.
      1. The submission status must be P for pending.
      2. The submission scope is the four-digit cruise year.
2. If this is the first OC_C submission for the calendar year, update the deliverable tracking spreadsheet with the date of first submission under OC_C.
3. Network copy the file into the staging area for validation at \\sean.glba.nps.gov\data\SEAN_Data\Staging\OC\OC_C.
   1. Put it in its own subdirectory whose name is the same as the submission number.
   2. Ensure its name meets the standards defined in Appendix J.
4. Unzip the file into its component CNV files in the staging area.
5. Invoke validation of the CNV files according to current criteria by using the web program at http://sean-dm.glba.nps.gov/OC_C_validate_DM.aspx.
   1. Select the pending OC_C submission from among those shown.
   2. Validation summary results are automatically recorded in the Submission_Log.
   3. See Appendix J for detailed validation criteria.
   4. A findings file is produced in the same directory as the data detailing validation faults.
6. If submission fails mandatory criteria, reply with a "failure email" that includes:
   1. The submission number assigned
   2. The deliverable ID
   3. The protocol ID
   4. A specific list of all the mandatory criteria failed by attaching the "findings.htm" file that was automatically created in the staging subdirectory
7. If submission passes mandatory criteria, reply with a "success email" that includes:
   1. The submission number assigned
   2. The deliverable ID
   3. The protocol ID
   4. List of any specific optional criteria failed (by attaching the "findings.htm" file that was automatically created in the staging subdirectory)
   5. Request to certify deliverable as complete.

C. Data Steward tasks

1. On receipt of a failure email:
   1. Make corrections so the deliverable meets mandatory criteria.
   2. Most errors will require correction and recertification of the underlying OC_B deliverable.
   3. Restart the process from the beginning.
2. On receipt of a success email, confer with Project Leader regarding any failed optional criteria:

1. If these are acceptable:
    1. Reply with a “certification email” stating the deliverable is certified and may be disseminated.
    2. Delete the obsolete intermediate files contained in …\CNV_Processed\temp\.
2. If these are unacceptable:
    1. Reply with a “withdrawal email,” stating the deliverable is withdrawn.
    2. Take remedial action to obtain a corrected deliverable.
    3. Restart the process from the beginning.

D. Data Manager tasks

1. On receipt of a withdrawal email:
    1. Mark the withdrawal in the Submission_Log’s Status column using the web tool.
    2. Terminate the process.
2. On receipt of a certification email:
    1. If sensitive information is in the unzipped deliverable:
        1. Products containing sensitive information cannot be disseminated.
        2. Mark the Submission_Log’s Status column as Sensitive using the web tool.
        3. Copy the submitted single zip file to test environment as AUXREP\OC\OC_C\SENSITIVE\CNV_YYYY.zip (no version letter in name). Create the folder if necessary.
        4. Notify the Project Leader and Data Steward the file(s) were sequestered due to sensitivity.
        5. Terminate the process.
    2. Update the certification in the Status column using Submission_Log using the web tool. Also update Date Certified and Certified By.
    3. Copy the submitted single ZIP file to Development environment as …\AUXREP\OC\OC_C\ CNV_YYYY.zip. Note no letter follows the YYYY in the certified file.
    4. Update the Development deliverable tracking spreadsheet with the date of certification for OC_C.
    5. Establish and test web link(s) on the Development website’s OC_main.aspx page.
    6. Update the formal metadata XML file in Development so it includes the new date range.
    7. Propagate the new and revised files from Development to Staging/integration environment.
    8. Test and then propagate from Staging/integration to Production environment.
    9. Verify deliverable(s) are accessible from production website.
    10. Update the Development deliverable tracking spreadsheet with dates for the Repository and Dissemination milestones.
    11. Create a PDF of all years from the latest tracking spreadsheet and propagate the PDF to Staging/integration and Production sites.
    12. Do not delete the individual CNV files from the staging area. They will be immediately needed for generating OC_D, which the Data Manager should initiate at once.

SOP 9: Postseason Quality Assurance and Calibration Evaluation

1 Summary

1. After the October cruise, the primary CTD is returned to Sea-Bird for calibration of the sensors. All sensors on the primary CTD must be calibrated. Also, the dissolved oxygen (DO) sensor on the backup CTD is always sent in for calibration, regardless of whether or not it was deployed during the cruise year. If the backup CTD was deployed at all during the season then the whole unit (all sensors), rather than just the DO sensor, must also be calibrated in order to evaluate degree of sensor drift for the data it collected.
2. Because no water samples are collected for within-survey calibrations of the conductivity, fluorometer, or nephelometer sensors, the annual calibrations provide the only means for the program to independently assess sensor accuracy.
3. The Temperature Calibration Report and Conductivity Calibration Report detail sensor drift between the current and previous instrument calibrations. Use the “As Received” calibration values for purposes of determining drift during the period of instrument use. For Glacier Bay measurements, which describe a dynamic coastal domain, sufficient accuracy of temperature (ºC) and salinity (PSU) data are achieved at the 0.01 and 0.03 levels, respectively. However, typical measurements will perform better than this, on the order of 0.002–0.005 for the temperature measurements and 0.01–0.02 for the salinity measurements. Water samples are not collected during the Glacier Bay cruises, so the monitoring program has only limited ability to assess and correct deviant readings.
4. After the calibration reports have been inspected, a data quality flag is assigned to each CTD cast, according to the criteria listed below. The process for setting database flags is detailed in SOP 11, OC_M.

2 Temperature Sensor Drift

1. Sea-Bird specifies typical drift of the temperature probes to be less than 0.002 ºC per year. Presuming no major problems are noted with the temperature sensor, no calibration adjustments to the temperature measurements should ever be required. Check the “drift since last cal” value on the report and ensure this value is below 0.01 ºC.
2. If the sensor offset is greater than 0.01, the cause should be determined through examination of the comments on the calibration report and/or in consultation with Sea-Bird. For offsets less than or equal to 0.01 ºC, the data quality flag should be marked as “Good.” For offsets between 0.01 ºC and 0.02 ºC the data quality flag should be set to “Questionable,” and for offset greater than 0.02 ºC the data quality flag should be set to “Bad.” In the rare case where the temperature calibration indicates a total drift of more than 0.01 ºC, the cause of such a large offset is to be documented in the comments field of OC_M.

3 Conductivity Sensor Drift

1. Particular care must be taken when assessing the conductivity calibration values, because drift and complete cell failure can result from a variety of causes. Biofouling of the conductivity cell causes measurable changes in accuracy; a crack in the glass cell can cause

partial (minimal) or near-complete sensor failure. Typical drift of a conductivity cell should be in the range of 0.001–0.0025 PSU/month.

2. If the calibration report indicates a total conductivity cell drift of greater than 0.06 (≈0.0025 PSU/month for a two-year calibration cycle), then document this large drift in the OC_M comments and adjust the data quality flag accordingly. The data quality flag is marked as "Good" if the total conductivity cell offset is less than or equal to 0.06 PSU. The data quality flag is marked as "Questionable" if the total offset is between 0.06 and 0.2 PSU, and the data quality flag is marked as "Bad" if the total offset is greater than or equal to 0.2 PSU.
3. For the purposes of the GLBA program, no postcalibration salinity adjustments are made. Without in situ water samples, it is generally not possible to determine when the offset was generated or whether the offset occurred as a slowly drifting change in sensor characteristics. Researchers who would care to make the assumption that the drift occurred linearly with time can access the archived calibration sheets and spread the drift evenly (in time), as detailed in *Sea-Bird Application Note #31*, which can be downloaded from the Sea-Bird website.
4. In the rare case where the salinity calibrations exhibit a total drift of more than 0.2 PSU, the cause of such a large drift is probably catastrophic conductivity sensor failure, and the Sea-Bird sensor calibration report may note some significant problem; this is to be noted in the comments field of OC_M. If no single event stands out as the likely cause of failure, none of the salinity data should be certified as "Good." If a likely cause for failure can be identified, the Project Leader will have the option of (1) certifying only data collected before this point in time with a "Questionable" data quality flag and marking data collected after this point in time with a "Bad" data quality flag, *or* (2) denoting all data collected as "Bad." Employing comparisons of measurements collected in previous years along with measurements collected in the year of sensor failure can help diagnose when such a failure may have taken place. The deepest measurements in the water column would be most appropriate for such comparisons because the dynamic range of salinity values is smaller in waters below the more highly variable surface waters.

SOP 10: Cumulative Database (OC_D Creation)

Summary

Immediately after certification of an OC_C submission, the individual validated CNV files are still available in the staging area. Data in these files are loaded into the staging database, deleting anything previously submitted for the stated cruise year. Certification is attested by the Data Manager, on the basis of the existing OC_C certification.

Following an OC_D update, the certified OC_M data quality flags for that year must always be applied (SOP 11). Once that is successfully completed, the production database must be updated to mirror the latest staging database.

All steps are performed by the Data Manager.

Detailed Steps

A. Data Manager tasks

1. Upon certification of OC_C, verify the year's unzipped CNV file set is still complete in the staging area.
2. OC_C has already been validated and needs no further quality control measures.
3. If the OC_C deliverable for the submission unit was marked sensitive in its Submission_Log entry:
    1. Create a Submission_Log entry for this OC_D using the web tool, marking the status as "sensitive."
    2. Update the Development copy of the annual deliverable tracking spreadsheet with the date of completion for OC_D and then propagate it to Integration/Staging and Production.
    3. Propagate only the tracking spreadsheet: sensitive data are never allowed in the database.
    4. Terminate the process.
4. Otherwise use web application http://sean-dm.glba.nps.gov/OC_DM_create_OC_D.aspx to create and validate the OC_D.
    1. From the choices offered on the screen, indicate which certified OC_C submission to use as the basis for the OC_D.
    2. The submission log entries will be automatically created and updated as progress is made.
    3. The OC_C components are revalidated.
        1. If the application discovers a mandatory criterion violated, this will be reported in the findings and the OC_D database will not be updated at all.
        2. Failure suggests a previously undetected flaw in the predecessor OC_C and possibly its underlying OC_B components: this must be investigated and corrected before an OC_D can be created.
        3. Be aware the database itself is constrained to enforce the mandatory validation criteria, and this sometimes catches violations that the revalidation process overlooks.
            1. This is a safety measure that absolutely guarantees the level of data quality and is standard practice in structured query language (SQL) databases.

      2. If a database-enforced constraint would be violated by a requested update, the entire process is aborted and no database rows are updated at all.
      3. If a constraint exception is encountered while processing an OC_D, then either the underlying OC_C data needs to be adjusted to conform to the mandatory validation criterion or the criterion needs to be changed in the protocol and a database programmer needs to alter the constraint to enforce the revised protocol.
   4. If this submission unit (i.e., cruise year) has previously been stored in the database, then the new data will totally replace the entire older submission.
      1. The web application will only erase and replace the earlier data if the operator confirms this with the “overwrite” button on the screen.
      2. If the loading of the new data fails later in the process, any erased prior data will remain erased. Remedial action will be needed to recreate it, typically by correcting the latest OC_C and resubmitting it.
   5. When complete, the web application updates the submission status. If it is not listed as Certified, check the screen’s execution log (or findings file in the OC_C’s staging directory) to determine the nature of the problem, correct the issue, and resubmit as a new deliverable.
   6. Verify completion by successfully viewing rows of the cruise year using the Integration website’s Data Query and Download function.
5. Once OC_D is successful, update the Development tracking sheet for the cruise year by entering the current date into rows “Automated deliverable generation”, “Deliverable certified”, and “Installed in staging database.” It is located in …/AUXREP/OC/.
6. If this OC_D was written over an earlier version of the cruise year, then any existing OC_M data quality flags will be erased. In such a case, the latest certified OC_M must be reapplied as explained in SOP 11.
7. Mirror the new data in the Production SQL database.
   1. Using SQL Server management studio or similar tool, update the Production database rows for the cruise year from the staging database.
      1. Due to current inadequate bandwidth, it is not practical to automate this function.
      2. A person knowledgeable of SQL Server operations is required to accomplish the mirroring.
   2. Update the Development tracking sheet for the cruise year by entering the current date into row “Staging database updates Ft. Collins” of the OC_D column.
8. Update IRMA Data Store.
   1. Generate a complete CSV file from the Production website by using the “Data Query and Download” function.
      1. Specify no filter parameters in order to obtain all rows.
      2. Save results in a CSV to a temporary location.
      3. Verify the number of rows reported is of the proper magnitude and the TIMESTAMP attribute on each row verifies the records are current.
   2. Using tools at //irma.nps.gov, locate the “Glacier Bay Oceanographic Monitoring” project.
   3. Bring up the associated “Tabular Dataset” reference.

    4. Using the IRMA interface, upload the CSV file to the holding and set it “Active.” Your network ID must be listed in IRMA as an owner of the reference in order to be allowed to upload the file.
    5. Update the Developing tracking sheet for the cruise year by entering the current date into row “Sent to/accepted by IRMA Data Store” under the OC_D column.

9. Create a PDF of all years from the latest tracking spreadsheet and propagate it to the Integration/Staging and Production environments.

SOP 11: Data Quality Assignment (OC_M Creation)

Summary

At the end of each survey year, a review is done to determine if recalibration data indicate that sensor drift over the season is significant. The original log sheet images are also reviewed for annotations regarding data exceptions. The raw and processed vertical profile data plots are reviewed both separately and jointly for irregular instrument readings.

The Project Leader flags questionable and unusable casts for the year using the data quality report spreadsheets. Inoperable individual sensors encountered during a cast are also noted on the sheets. The Data Manager, after validating the spreadsheet forms, posts the forms to the web and then updates appropriate columns in the cumulate database to reflect quality levels of all observations.

Detailed Steps

A. Project Leader tasks

1. Obtain a blank Data Quality Report form from the "Toolbox" link on the SEAN website.
    1. Its form is an XLSX workbook.
    2. Repeatedly copy the "template" tab until there are enough blank spreadsheets to hold every dump in the cruise year.
    3. Rename each tab with the four-digit dump number it reflects.
    4. Head the top of each form with cruise-specific information taken from the OC_H field log sheets.
    5. Record results of the analyses described below on the appropriate sheet.
        1. Use the analysis order shown below.
        2. If a cast is marked "bad" at a point in the process for any reason, no further quality review for that cast is performed.
        3. If a cast is marked "questionable," review continues in order to determine if it should be further marked down to "bad."
2. Review the latest certified calibration certificates.
    1. Examine the certified images on the SEAN website of the pre- and postseason calibration documents (deliverable OC_G).
    2. Following the guidance in SOP 9, note any data quality exceptions on the data quality report sheets.
    3. Be aware it is possible this may impact the entire season if a serious drift was present.
3. Review all certified field log sheet images for the year on the website (deliverable OC_H).
    1. Individual cast exceptions may be found in the COMMENTS field of the field log sheet image.
    2. Overall cruise exceptions and problems may be found in the NOTES field of the log sheet.
    3. Be sure to check the back side image of each sheet for any further quality details.
    4. Mark technically flawed casts as "bad" on the quality spreadsheet.
        1. Use the codes listed at the bottom of the sheet, which follow the standard used by the Ocean Data View system.

        2. Include a brief explanatory comment for any bad cast. Each comment will be embedded in the Data Quality Comment column of the cumulative database in order to inform future researchers when they select data to work with.
        3. Data Quality Comments should *not* be recorded for casts having "Good" quality.
    5. Mark and comment casts as questionable if one or two sensors appear faulty for some or all of a cast.
        1. It isn't possible to provide a quality rating at the CTD/dump/cast/individual-sensor level, so any problem has to be recorded for the cast as a whole.
    6. Check appropriate boxes on the Data Quality Sheet to mark any failed or disconnected sensors for particular casts or for the dump as a whole.
        1. When the OC_M is later applied to the OC_D database, this will cause the database to have nulls in the corresponding cells, removing the wild readings typical of broken sensors.
4. Review the raw in-season profile plots for individual casts made for quality assurance purposes during the season (SOP 7).
    1. Mark and comment as "questionable" casts having one or two improbable plot lines.
    2. Mark and comment as "bad" casts displaying three or more improbable plot lines.
5. Review the processed postseason profile plots made for individual casts made for quality assurance purposes after the season (SOP 8).
    1. Mark and comment as "bad" casts for which nothing is plotted.
        1. The signal processing applications discard observations that are widely outside acceptable limits. In a seriously failed cast it is possible for all points to be deleted.
    2. Compare processed postseason plots against raw in-season plots.
        1. If strong discrepancies appear, investigate possible causes.
        2. The Project Leader's judgment, following currently accepted practices in the field, will determine whether to mark casts as questionable or bad, based on in-season/postseason plots.
6. Submit the deliverable XLSX file via email attachment to the Data Manager for validation.
    1. Specify in the message body it is deliverable OC_M for cruise year YYYY, as defined in protocol OC-2014.1.

B. Data Manager tasks

1. On receipt of the submission, assign the next formal submission number to this file.
    1. Use the "Update Submission Log" web tool on the NPS network at http://sean-dm.glba.nps.gov/0_submission_update.aspx.
    2. Complete Submission_Log details up through the Submission_Date column.
    3. Use Cruise Year as the submission unit.
2. If this is the first OC_M submission for the cruise year, update the deliverable tracking spreadsheet with the date of first submission under OC_M.
3. Save the attached file to the staging area for validation as \\sean.glba.nps.gov\data\SEAN_Data\Staging\OC\OC_M\nnnn\Quality_YYYY.xlsx, where nnnn is the submission number and YYYY is the cruise year.
4. Verify the OC_A/OC_G postseason calibration deliverables have been certified.

    1. Postseason calibration provides required information for producing OC_M.
    2. Be sure the date for "Postseason calibration assessment" is recorded in the OC_M column of the deliverable tracking spreadsheet. Add it if necessary.
5. Validate the XLSX file according to current criteria.
6. Record validation deliverable status in the Submission_Log using the web tool.
7. If submission fails mandatory criteria,
    1. reply with a "failure email" that includes:
        1. The submission number assigned
        2. The deliverable ID
        3. The protocol ID
        4. Documentation listing all the specific mandatory and optional criteria failed
    2. Update the submission log with error counts, date validation attempted, and status of "F" for failed.
8. If submission passes mandatory criteria, reply with a "success email" that includes:
    1. The submission number assigned
    2. The deliverable ID
    3. The protocol ID
    4. Documentation listing any specific optional criteria failed
    5. Request to certify deliverable as complete

C. Project Leader tasks

1. On receipt of a failure email:
    1. Make corrections so the deliverable meets mandatory criteria.
    2. Restart the process from the beginning to initiate a new submission with the corrected deliverable candidate.
2. On receipt of a success email, review any failed optional criteria:
    1. If these are acceptable:
        1. Reply with a "certification email" stating the deliverable is certified and may be applied to the database and disseminated.
    2. If these are unacceptable:
        1. Reply with a "withdrawal email," stating the deliverable is withdrawn.
        2. Take remedial action to obtain a corrected deliverable.
        3. Restart the process from the beginning.

D. Data Manager tasks

1. On receipt of a withdrawal email:
    1. Mark the withdrawal in the Submission_Log's Status column with the web tool.
    2. Terminate the process.
2. On receipt of a certification email:
    1. Verify the OC_D for the cruise year has been marked as certified. If not, notify the Project Leader that certification cannot be registered until OC_D has been certified and suspend processing until OC_D is ready.
    2. Due to the nature of these data, no sensitive information is in the deliverable.

3. Generate a PDF version of the single spreadsheet file containing all sheets in the workbook to staging directory, naming it Quality_YYYY.PDF.
4. Copy the staged certified spreadsheet and PDF files to the Development environment at …\AUXREP\OC\OC_M\.
5. Create and test web page links to the new file.
6. Copy the revised files to the Staging/Integration environment and test they are accessible.
7. Update the staging database contents to reflect quality flags and adjustments listed on the OC_M.
    1. Use the OC_M update tool on the Data Management website at http://sean-dm.glba.nps.gov/OC_DM_update_OCM.aspx.
    2. Apply updates with care. There is no way to undo application of OC_M without recreating the underlying OC_D data.
8. Mark the certification in the Status column in Submission_Log using the web tool.
    1. Mark any previously certified submission for this unit as decertified.
9. Update the deliverable tracking spreadsheet with the date of certification for OC_M.
10. Propagate from Staging/Integration to Production environment, including revised database content.
    1. Due to infrastructure limitations, moving database content to Production is queued up but only executed about once per year.
11. Verify deliverable(s) are accessible from Production website.
12. Update the deliverable tracking spreadsheet in Development with dates for the Repository and Dissemination milestones.
13. Create a PDF from the latest tracking spreadsheet containing all years and propagate it to all websites.
14. Perform an update for both the NODC and IRMA Data Store copies of the revised OC_D data, if they have previously been run through certification.

SOP 12: Field Log Sheets (OC_H Creation)

Summary

The complete sets of paper field log sheets that have been accumulating over the survey year are collected. They are double-side scanned into a single PDF for the year. The PDF is submitted through the validation and quality assurance iterations until certified.

SOP 12 requires users to work in the internal NPS network under valid Active Directory accounts. Access questions should be directed to the Data Manager.

Detailed Steps

A. Project Leader tasks

1. At the end of the cruise year, retrieve from files the paper field log sheets that have been recorded during the season.
2. Arrange them in dump number order.
3. Verify the set is complete. The dump number should continuously increment with no gaps. If a sheet is discovered missing for a dump, insert a page of paper in the stack listing the dump number and stating "No Field Log Sheet."
4. Scan the entire packet into a single PDF file using park scanner and associated software.
    1. Be sure the scanner is set for two-sided scanning, or be prepared to duplex them by hand.
        1. If scanner has a setting to "skip blank pages" be sure it is enabled.
    2. Save the PDF on park network at \\files.glba.nps.gov\Science\Data\Oceanography\Data\YYYY\Field_Log_Sheets\ where YYYY is the survey year covered, e.g., 2011. Name the file LOG_YYYY.PDF, once again substituting the year for YYYY.
5. Submit the single PDF file via email attachment to the Data Manager for validation, specifying in the message body it is deliverable OC_H, for year YYYY, as defined in protocol OC-2014.1.

B. Data Manager tasks

1. On receipt of the submission, assign the next formal submission number to this file, as found in the master Submission_Log table.
    1. Use the "Update Submission Log" web tool on the NPS network at http://sean-dm.glba.nps.gov/0_submission_update.aspx.
    2. Complete Submission_Log details up through the Submission_Date column.
2. Save the attached file into the staging area for validation at \\sean.glba.nps.gov\data\SEAN_Data\Staging\OC\OC_H.
3. Validate the submission according to current criteria.
4. Record validation summary data in the Submission_Log using the web tool.
5. If submission fails mandatory criteria, reply with a "failure email" that includes:
    1. The submission number assigned
    2. The deliverable ID
    3. The protocol ID
    4. Documentation listing all the specific mandatory criteria failed

6. If submission passes mandatory criteria, reply with a “success email” that includes:
    1. The submission number assigned
    2. The deliverable ID
    3. The protocol ID
    4. Documentation listing any specific optional criteria failed
    5. Request to certify deliverable as complete

C. Project Leader tasks

1. On receipt of a failure email:
    1. Review the paper stack is in order.
    2. Rescan or edit the PDF to ensure it is in the proper form.
    3. Resubmit
    4. If failure cannot be resolved, email the Data Manager that the submission is withdrawn.
2. On receipt of a success email, review any failed optional criteria:
    1. If these are acceptable:
        1. Reply with a “certification email” stating the deliverable is certified and may be disseminated.
    2. If these are unacceptable:
        1. Reply with a “withdrawal email,” stating the deliverable is withdrawn.
        2. Take remedial action to obtain a corrected deliverable.
        3. Restart the process from the beginning.

D. Data Manager tasks

1. On receipt of a withdrawal email:
    1. Mark the withdrawal in the Submission_Log’s Status column using the web tool.
    2. Terminate the process.
2. On receipt of a certification email:
    1. Verify no sensitive information is in the deliverable. Products containing sensitive information cannot be disseminated.
        1. Products containing sensitive information cannot be disseminated.
        2. Sensitivity is highly unlikely for this deliverable.
        3. If sensitive,
            1. Copy the submitted file to …\AUXREP\OC\OC_H\Sensitive\ in the Development environment. Create the \Sensitive\ folder if necessary.
            2. Mark the sensitivity in the Submission_Log’s Status column using the web tool.
            3. Notify the Project Leader the file was sequestered due to sensitivity.
            4. Propagate the resulting files to Staging/Integration and then Production.
            5. Terminate the process.
    2. Copy the submitted file to Development environment at AUXREP\OC\OC_H\.
    3. Create and test web links to access the file.
    4. Propagate from Development to Staging/Integration and then to Production environment.
    5. Verify deliverable is accessible from Production website.
    6. Mark the certification in the Status column in Submission_Log using the web tool.
        1. Mark any previous certified submission for this unit as decertified.

7. Update the deliverable tracking spreadsheet in Development environment at AUXREP\OC\with the date of completion for OC_H, generate a PDF, and propagate it to Staging/Integration and Production.

SOP 13: Data Availability Matrix (OC_J Creation)

Summary

Once the OC_D database update has been certified for the year, the coverage must be publicly documented in OC_J. The Data Manager retrieves the most recent OC_J version as an Excel spreadsheet. A database query is executed for the year to show by month the presence of readings for temperature, salinity, PAR, OBS, fluorometry, and DO. The spreadsheet is updated to reflect this and saved. A PDF is made of the new spreadsheet. It is installed in the repository for dissemination.

All tasks are performed by the Data Manager.

Detailed steps

1. Retrieve the most recent Excel spreadsheet version of deliverable OC_J from the Integration site at …\AUXREP\OC\OC_J\.
2. Resave it in Development as AUXREP\OC\OC_J\YYYYMMDD.xlsx.
   1. Filename is date of creation, (i.e., today).
   2. YYYY is four-digit year.
   3. MM is two-digit month with leading zero if needed.
   4. DD is two-digit day with leading zero if needed.
3. Query the detailed database for a count of parameters recorded over the scope of deliverable OC_D, grouped by year, month, CTD, and sensor type.
   1. In the Data Management website use the link for Report OC_J Basis (http://sean-dm.glba.nps.gov/OC_J_view_DM.aspx).
   2. Update YYYYMMDD.xlsx cell icons so they reflect the scope of data found by the query.
   3. If this is the first deliverable reported for the latest survey year, an additional row must be added to the top of the sheet and populated. If this is done due to a resubmission or recertification to the original OC_D, then the original row should be directly altered.
4. Exhaustively compare results against one year prior.
   1. Any changes to the CTD capabilities should be reflected.
   2. If expected changes do not appear, suspend the process until the nature of the fault is determined and remediation steps are identified and performed.
5. Spot check older sheet cells against the comprehensive database query.
   1. Exhaustive comparison is not required because these are not likely to change.
   2. If the query does not appear consistent with the existing history, investigate cause to determine whether it is the result of normal operations or of an error introduced into the database.
   3. If the result appears caused by a failure that requires remediation, then launch an ad hoc effort to fully diagnose and repair damage.
6. If no inconsistencies were detected above, then save the new components of OC_J.
   1. Resave the updated YYYYMMDD.xlsx.
   2. Also save YYYYMMDD.xlsx as a PDF file named YYYYMMDD.PDF.

    3. Copy YYYYMMDD.xlsx over file current.xlsx, which will be the basis for the next deliverable cycle.
    4. Copy YYYYMMDD.pdf over file current.pdf, which is the information disseminated by the website.
7. Verify the new OC_J is being properly served by the Development website.
8. Copy the updated XLSX and PDF files from Development to Staging/Integration and verify they are properly served from that site.
9. Update the deliverable tracking spreadsheet in Development’s AUXREP\OC\ with the date of completion for this OC_J, test it, and copy it to Staging/Integration.
10. Propagate the deliverable files from Staging/Integration to Production
11. Create a new Submission_log entry using the Data Management web tool and reflect the certification in the Status and date-related columns. Mark the previously certified OC_J as decertified.

SOP 14: Annual Data Report (OC_K Creation)

The Annual Data Report summarizes the field efforts of the previous sampling year, provides graphical and tabular summaries of collected data, and places these data within historical and regional contexts so that unusual observations can be identified. The sampling year ends with the October cruise, so the final certified data does not become available until after the instrument returns from the Sea-Bird calibration facility, typically in early January. The Annual Data Report is normally generated in February.

Because water column samples of phytoplankton, suspended sediment, and dissolved oxygen are not collected and analyzed, the ancillary data sensors cannot be quantitatively compared on an intercruise or interannual basis, and certainly not within the same cruise (it is acceptable to compare measurements within the same cast, however). For example, different phytoplankton species have different responses as measured by the fluorometer. Consequently, even within a single cruise, data are not directly comparable because phytoplankton communities within a fjord near a glacier may well have different species compositions from communities more closely connected to the Gulf of Alaska. Similarly, field personnel have no way to calibrate the OBS sensor in situ to particle size distribution, shape, color, reflectivity, etc., so turbidity measurements among casts and cruises must be interpreted with considerable caution. Nonetheless, it is important to examine these data (on a relative scale) in order to note possible significant changes in the character of these parameters over time.

1 Annual Report Format and Content

The Annual Data Report follows the NPS Natural Resource Technical Report format (http://www.nature.nps.gov/publications/nrpm/nrrnrtr.cfm) and contains the following sections and content:

1. **Introduction:** Overview of the monitoring program and its history, personnel involved
2. **Methods:** Summary of the sampling methodology, timing of fieldwork
3. **Coverage:** Chart showing what stations were occupied in which months
4. **Synopsis of operations:** Overview of the year, what went well, what problems cropped up, what needs particular attention in the coming year. Summary of observation comments and notes recorded on the field log sheets. Formal protocol revisions that went into effect.
5. **Results:**
    1. *Tables summarizing basic measurement and statistics*. Provide the mean, maximum, minimum, and standard deviation (as appropriate) of designated parameters in the upper 50 m of the water column from all cruises (for each core station). Parameters will include temperature, salinity, density, vertical density gradient, fluorescence, oxygen, OBS, and PAR. (See example in Section 2, following.) A second table will depict water column conditions from near the bottom at each station.
    2. *Analysis of Station 04 with respect to historical data*. Vertical profile plots or tables of the temperature and salinity measurements from Station 04 in all cruises along with historical mean and +/– one standard deviation.

   3. *Horizontal cross-sections*. Horizontal cross-sections of temperature, salinity, density, fluorescence, oxygen, and OBS from the midsummer (July) and midwinter (December–early February) cruises. For each of the cruises with cross-section plots, one set of cross-sections should show the data extending from Icy Strait to the head of the West Arm, and a second set should show the data from Icy Strait to the head of the East Arm.

6. **Discussion:** Summary of observations based on tables and figures presented in the Results section. Note in particular any anomalous conditions that persist through multiple sampling periods, multiple years, and/or across domains, as well as discussing regional geographic context.

2 Content of Results Section (i):
Tables Summarizing Basic Measurements and Associated Statistics

In order to assess the measurements made within each cruise, standard statistical summary tables (Figure SOP 14.1), and plots are created by the Project Leader with help from the Data Manager and Data Steward accessing the certified database.

These tables are useful to other researchers conducting marine-related studies in the park. Such data tables can be incorporated directly into their analyses, and the Annual Data Report provides sufficient context for interpretation of these measurements.

Rows of each table describe each field effort conducted through the year and at each core station. Columns of the data tables contain the 0–50 m depth level mean, maximum, minimum, and standard deviation for all of the following parameters: temperature, salinity, density (sigma-*t*), vertical density gradient, fluorescence, dissolved oxygen concentration, OBS, and PAR. Exceptions to the reported statistics are for (1) the density gradient parameter, which requires reporting of the mean, maximum, and depth of maximum only; and (2) the PAR measurement, which requires the mean, minimum, and maximum values only. For purposes of this report, vertical density gradient is calculated as (density at next lower bin – density at next higher bin) x 0.5. The top and bottom depth bins of each cast have no vertical density gradient. Figure SOP 14.1 shows example table setups for reporting these statistics.

The 0–50 m depth level captures the portion of the water column where the majority of primary production, macronutrient utilization, phytoplankton standing stock, thermal stratification, and low-salinity lenses all occur. Thus, summarizing this portion of the water column provides a broad perspective on the physical, chemical, and primary productivity components of the system.

The near-bottom summary table provides information about (1) bottom water renewal rates and timing within the fjord, (2) nutrient budget cycle dynamics, and (3) connectivity of the fjord with the outside waters.

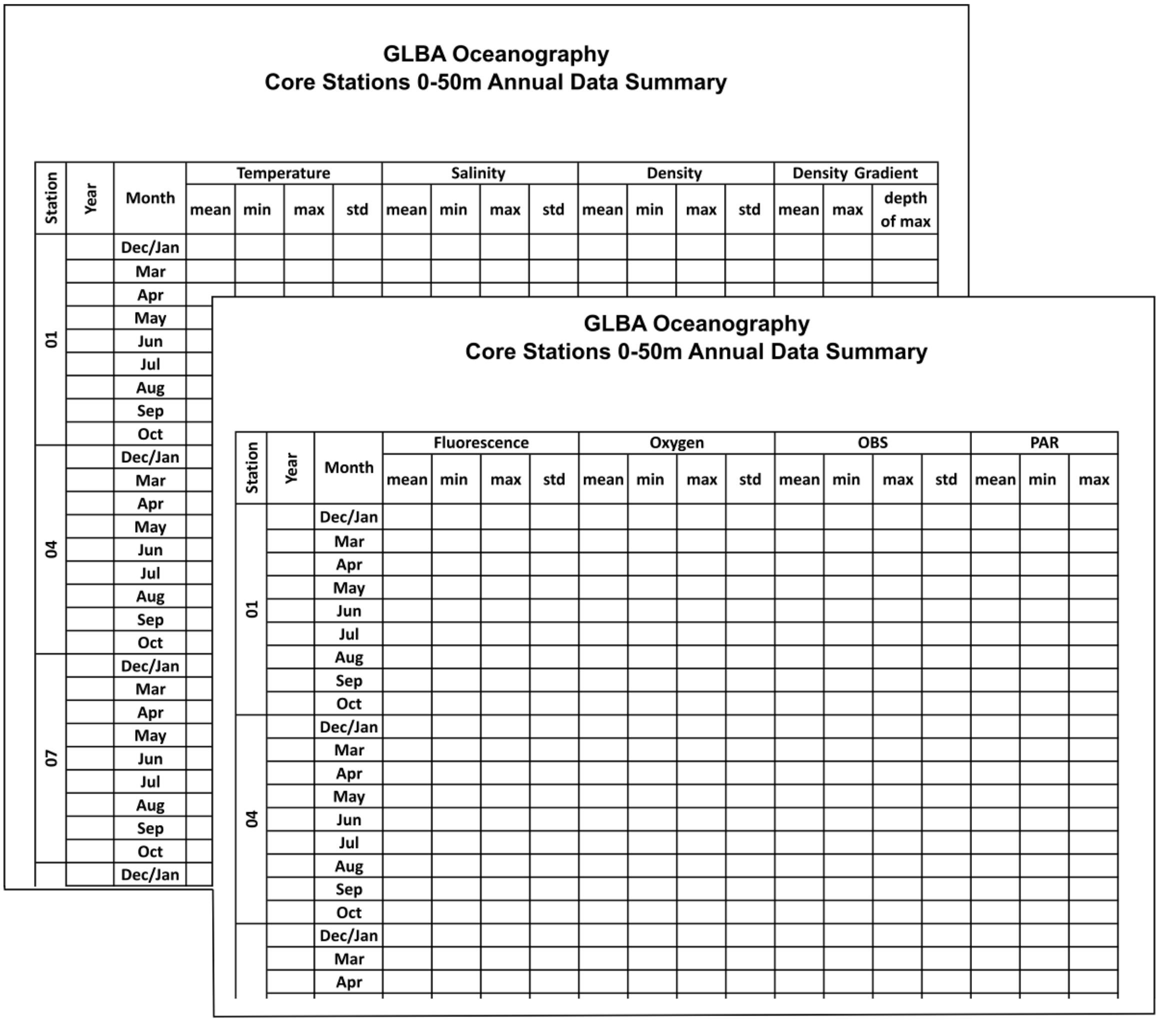


Figure SOP 14.1. Example data summary tables for reporting the basic measurement and statistics collected at the core station set.

3 Content of Results Section (ii): Analysis of Station 04 with Respect to Historical Data

Using data from Station 04 only, vertical profiles (temperature vs. depth, and salinity vs. depth) are plotted along with the climatologic mean profile in order to assess the relation of the current data to the long-term mean (Figure SOP 14.2). The data are also tabulated so that the values shown in the plots are easily accessible to managers and other researchers (Table SOP 14.1). Station 04 is selected for this analysis because it represents a deep station inside the main sill of the fjord and with close connection (proximity) to the West Arm, East Arm, and Lower Bay domains.

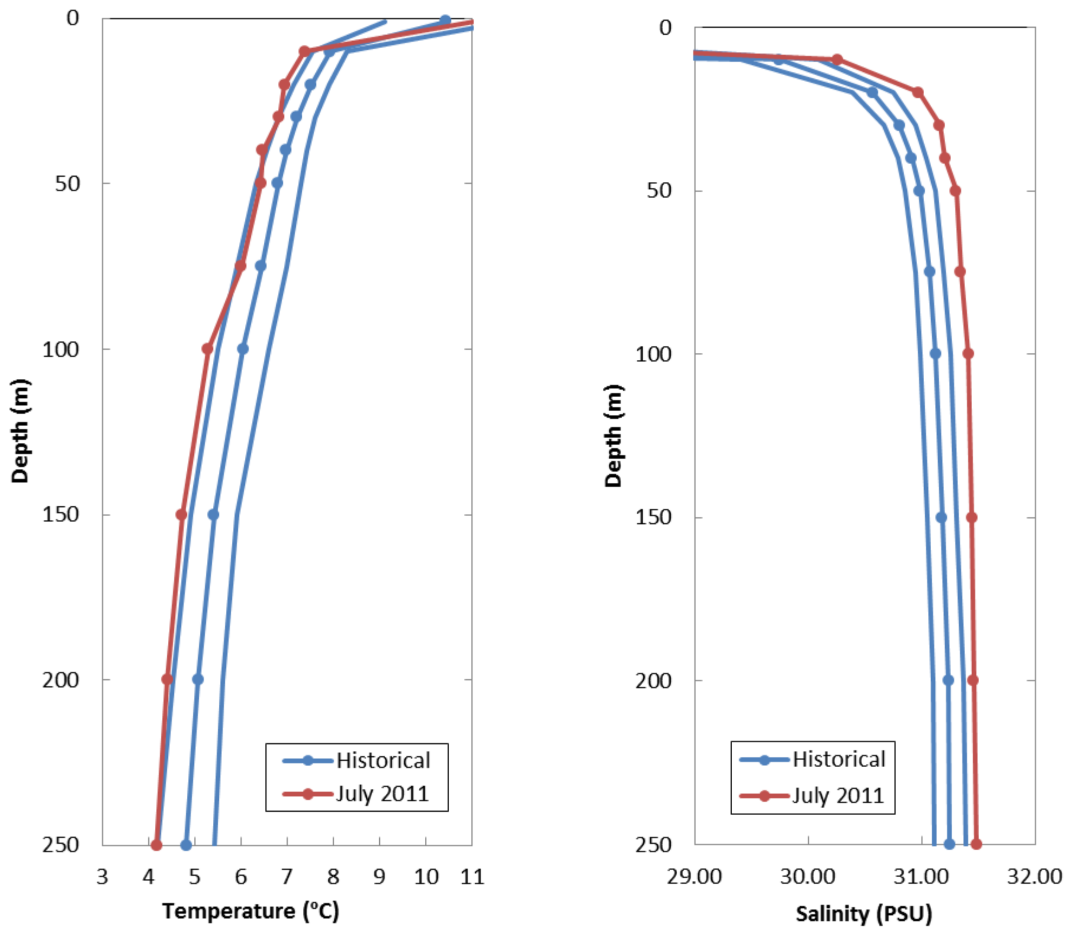


Figure SOP 14.2. Example vertical profiles of water temperature (left) and salinity (right) shown along with historical. Data are taken from oceanographic Station 04 in Glacier Bay. Plotted are the current data (July 2011, red with dots) and July 1993 through July 2010 mean values (blue with dots) along with +/– bounds of one standard deviation to either side of the historical mean (blue without dots). Only a subset of the full vertical profile has been displayed here: the 0, 10, 20, 30, 50, 75, 100, 150, 200, and 250 m depth levels. From this plot, we see that waters in July 2011 are anomalously cold below 75 m depth, whereas the waters are anomalously salty throughout the water column.

Error bounds of one standard deviation plotted to either side of the monthly climatology will allow the profile of interest to be assessed as to whether the monthly values' deviations (from the monthly climatology) are considered "normal" or "anomalous." An anomalous value is defined as one with observations that fall beyond one standard deviation of the mean of that month's historical measurements. Therefore, by definition of one standard deviation and the assumption of a normal distribution, 68% of all years will be considered "normal" and 32% will be considered "anomalous." Anomalous measurements are noted in the discussion section of the report. Observations that fall outside of two standard deviations (~95% of normally distributed observations) represent very unusual occurrences and deserve particular attention within the annual report.

Table SOP 14.1. Example data table: tabular display of the same data presented in Figure SOP 14.2. To help draw attention to anomalous measurements, observations made in July 2011 that lie outside one standard deviation of the long-term mean are emphasized in ***bold italic*** type.

	Station 04 Temperature (°C)					Station 04 Salinity (PSU)				
Depth (m)	**July 2011**	**Historic July mean**	**Historic mean 1 SD**	**Historic mean +1 SD**	***n***	**July 2011**	**Historic July mean**	**Historic mean –1 SD**	**Historic mean +1 SD**	***n***
0	11.04	10.44	9.11	11.76	15	24.62	22.59	19.30	25.88	15
10	***7.38***	7.93	7.56	8.30	15	***30.26***	29.75	29.41	30.09	15
20	***6.95***	7.53	7.15	7.91	15	***30.97***	30.57	30.39	30.75	15
30	6.83	7.21	6.82	7.61	15	***31.16***	30.80	30.66	30.94	15
40	***6.47***	6.98	6.54	7.42	15	***31.20***	30.91	30.79	31.03	15
50	6.43	6.81	6.32	7.30	15	***31.30***	30.99	30.85	31.12	15
75	6.02	6.45	5.91	7.00	15	***31.35***	31.07	30.94	31.20	15
100	***5.29***	6.06	5.51	6.60	14	***31.41***	31.12	30.99	31.25	14
150	***4.73***	5.42	4.92	5.93	14	***31.44***	31.18	31.05	31.31	14
200	***4.41***	5.08	4.54	5.61	13	***31.46***	31.24	31.10	31.37	13
250	***4.19***	4.82	4.21	5.44	7	***31.48***	31.25	31.11	31.39	7

These tables and vertical profile plots are generated for a select subset, the "standard oceanographic" depths: 0, 10, 20, 30, 40, 50, 75, 100, 150, 200, 250, 300, 400, and 500 m depth levels.

4 Content of Results Section (iii): Horizontal Cross-sections

Horizontal cross-sectional plots are generated by the Ocean Data View (ODV) (http://odv.awi.de/) or other scientific graphics software. An ASCII data table provided by the Data Manager that contains the full "flattened" dataset can be imported directly into ODV. Parameters to plot include temperature, salinity, fluorescence, oxygen, and OBS, and the transect includes stations from Icy Strait to the head of West Arm. Figure SOP 14.3 shows an example horizontal cross-section figure along the Glacier Bay transect.

These figures provide a visual depiction of the data collected with the highest spatial resolution. Features within the figures lend themselves to interpretation and discussion of biophysical processes that are important to understanding the dynamics of the Glacier Bay marine ecosystem.

5 Validation and Submission of the Deliverable

The final version of OC_K is generated as a DOCX file by the Project Leader. It is passed to the Data Manager for processing as an NRTR by the NPS publications staff. Once the publications group approves the final product, the data manager creates a PDF file and performs the protocol-defined validation checks. Eventually the report is confirmed certified through the standard workflow described in Chapter 4. The Data Manager installs the final PDF in the auxiliary repository, creates a web link for it, updates the Deliverable Product Tracking grid, and forwards the final OC_K to NPS's IRMA Data Store.

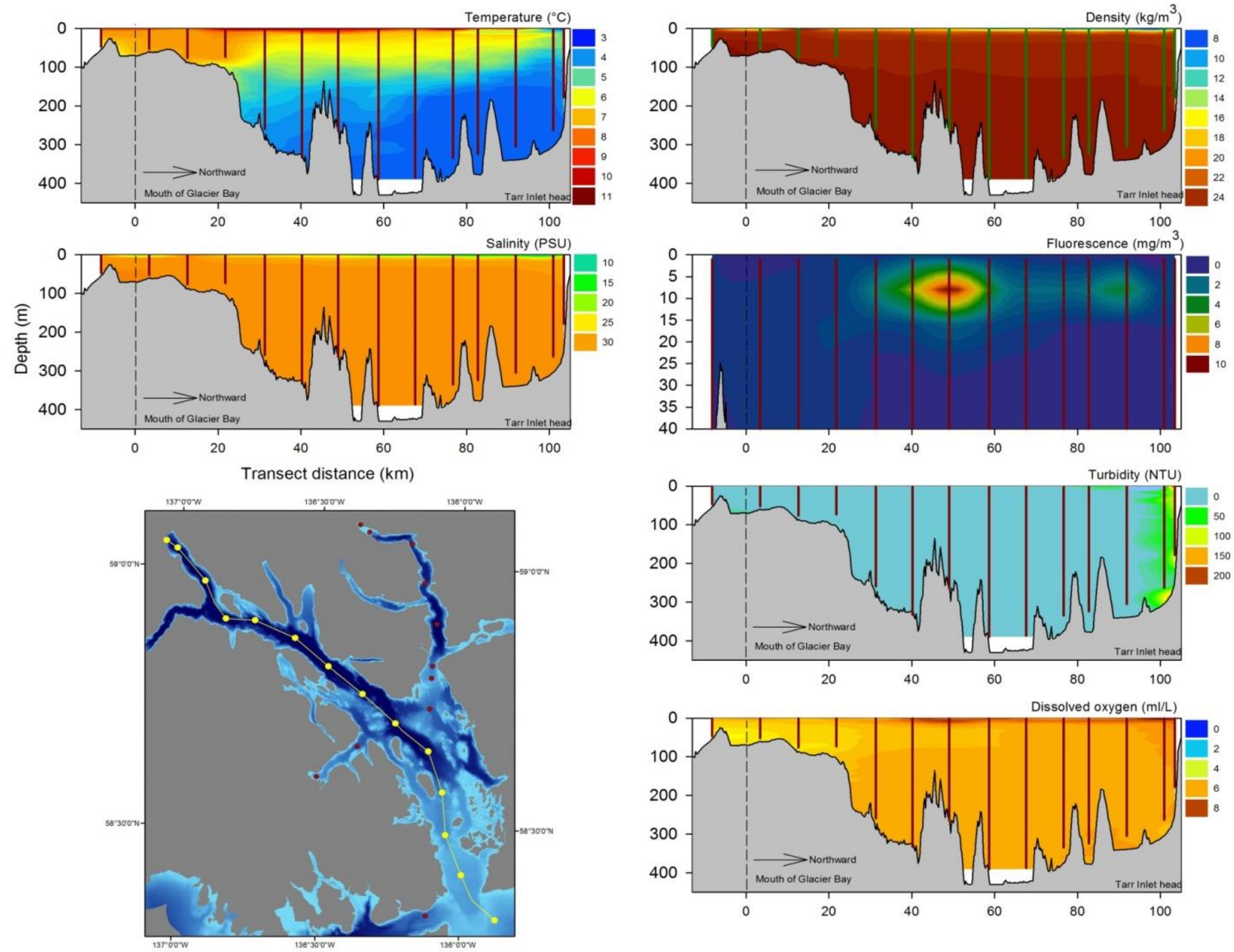


Figure SOP 14.3. Example ODV-generated cross-sectional contour plots using Glacier Bay CTD data collected in July 2011. The map in the lower left-hand corner depicts station locations as yellow dots, along with a line transect. On the contour plots, the mouth of Glacier Bay (Station 00) is located at 0 km on the horizontal axis.

SOP 15: Five-Year Report (OC_L Creation)

Beginning in 2012 and every five years thereafter, the Project Leader, with appropriate SEAN-funded external technical assistance, will undertake trend analyses and comparison of the monitoring program dataset to other regional datasets for the purpose of placing observed signals into broader temporal and regional contexts.

1 Five-Year Report Format and Content

The Five-Year Report will contain the following subsections and content:

1. **Introduction:** Overview of the monitoring program and its history
2. **Methods:** Summary of the sampling methodology
3. **Coverage:** Chart showing what stations were occupied in what months and years
4. **Results:** Analyses are driven mainly by observed features noted within the Glacier Bay dataset. The Five-Year Report will include the following four components:
    1. Analysis of spatial extent of observed anomalies
    2. Trend analysis
    3. Time series analysis
    4. Comparisons to other surface and profile data
5. **Discussion:** Summary of observations based on tables and figures presented in the Results section.

2 Content of Results Section (i): Analysis of Spatial Extent of Observed Anomalies

For the same reasons as for the Annual Data Report, Station 04 is given particular attention in the five-year data reports. The Five-Year Report should describe the extent to which Station 04 anomalies are representative of anomalies observed at the other core Glacier Bay stations (and other oceanographic stations in the larger region) through use of basic statistics: mean, standard deviation, and cross-correlation computations will suffice. This analysis will help place interpretation of the Station 04 results into a broader spatial context.

3 Content of Results Section (ii): Trend Analysis

The Five-Year Report will present monthly anomaly time series, which includes station-by-station plots of the *difference between observed and long-term mean monthly values*. This manipulation removes the mean annual signal (represented by the monthly climatology) from the time series and allows for straightforward interpretation of different signals. Examples of such analyses are available at the GAK1 time series web page: http://www.ims.uaf.edu/gak1/ and in Figure SOP 15.1 below. Analyses will be performed at a selection of depth levels that provide a representative depiction of the water column. Employ the standard oceanographic depth levels of 0, 10, 20, 30, 40, 50, 75, 100, 150, 200, 250, and 300 m.

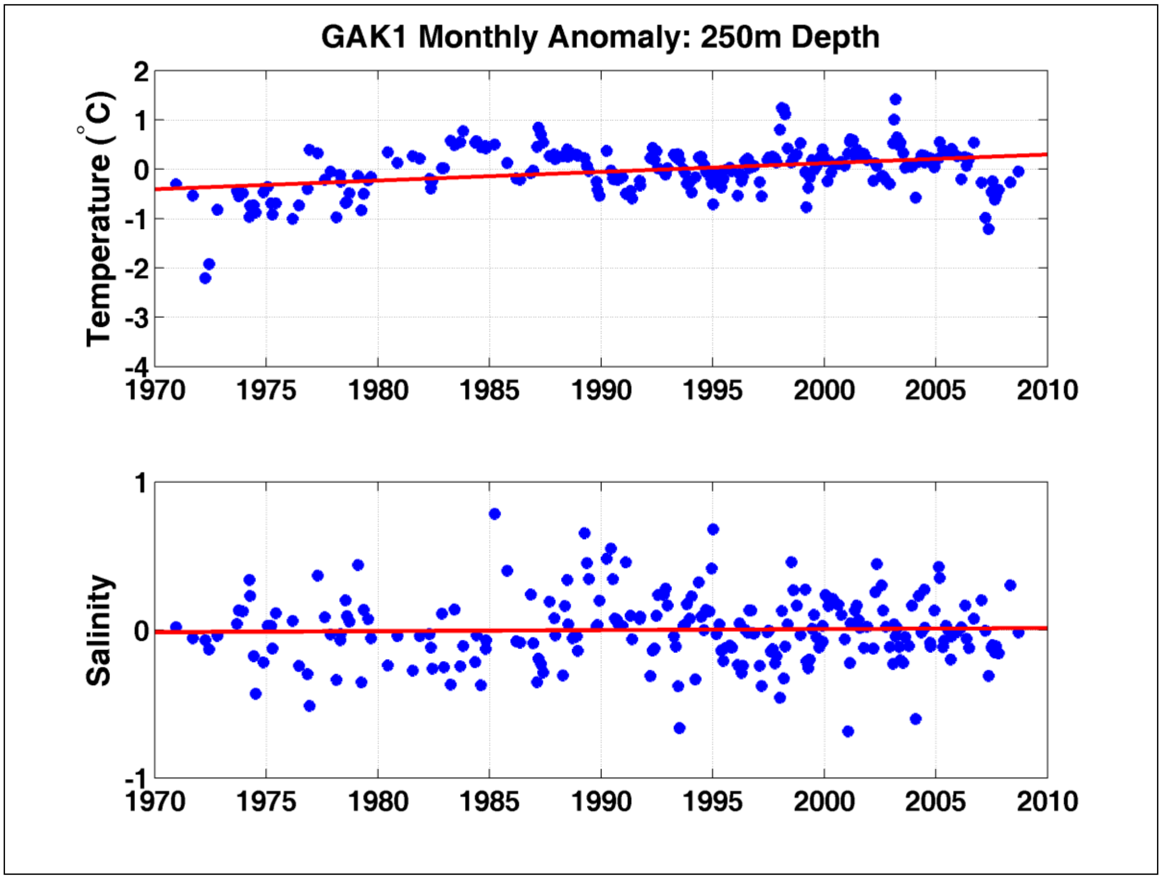


Figure SOP 15.1. Example anomaly plots of temperature (top) and salinity in PSU (bottom) along with the least-squares best fit linear trend (red) to each time series for oceanographic station GAK1. In these plots, the mean annual signal (monthly climatology) has been subtracted from the present month's measurements, resulting in a zero mean anomaly time series. The plots show that the mean 250 m temperature has increased by nearly 1 ºC over the last 35 years, whereas the salinity has remained essentially unchanged. The most recent two years (2007 and 2008) show temperatures well below the long-term trend line, indicating a recent prolonged cold spell. Temperatures through most of the 1980s, however, were mostly higher than normal.

4 Content of Results Section (iii): Time Series Analysis

When the GLBA dataset is sufficiently long, spectral analysis techniques (e.g., Fourier analysis) will be appropriate for evaluating cyclic and quasi-cyclic phenomena. To ensure statistically robust interpretations, Fourier analysis requires a time series to be about 10 times the length of the period for the signal of interest. Thus, to well resolve the (approximately) three-year El Nino (Southern Oscillation Index) signal, a time series approaching 30 years will be required.

The GLBA oceanographic time series trends and anomalies should also be compared to other regional datasets collected in the northeastern Pacific. These comparisons should include investigations of regime shifts (e.g., step or state changes) and periodic or quasi-periodic phenomena.

Oceanographic data sets for comparison include (but are not necessarily limited to):

1. The GAK1 time series
2. Oceanographic measurements from the mouth of Resurrection Bay, Alaska. Dataset maintained by the University of Alaska: http://www.ims.uaf.edu/gak1/
3. The Line P and Ocean Station Papa time series
4. Oceanographic measurements from 50 N, 140 W. Dataset maintained by the Canadian Department of Fisheries and Ocean Sciences (DFO) at the Institute of Ocean Sciences (IOS): http://www.pac.dfo-mpo.gc.ca/science/oceans/data-donnees/line-p/index-eng.html.
5. Canadian "lighthouse" time series
6. Sea surface temperature and salinity measurements from lighthouses located along the Canadian Pacific coast. Dataset maintained by DFO-IOS: http://www.pac.dfo-mpo.gc.ca/science/oceans/data-donnees/lighthouses-phares/index-eng.html
7. National Data Buoy Center (NDBC) moorings and coastal station datasets: http://www.ndbc.noaa.gov/
8. Oceanographic and meteorological data sets located throughout Southeast Alaska

Companion plots of environmental and climate time series may be employed to help interpret the oceanographic findings within a broader context. Cross-correlation techniques can help identify possible linkages between the local Glacier Bay system and the companion time series.

Data sets for comparison include:

1. Local atmospheric variables:
    1. Wind, temperature, and precipitation datasets available from the National Climate Data Center (NCDC) www.ncdc.noaa.gov and the National Data Buoy Center (NDBC) www.ndbc.noaa.gov.
    2. The Bakun Upwelling index available from the Pacific Fisheries Environmental Laboratory: http://www.pfeg.noaa.gov/products/PFEL/modeled/indices/upwelling/NA/upwell_menu_NA.html
    3. Variables computed by atmospheric reanalysis models such as the National Center for Environmental Prediction/National Center for Atmospheric Research (NCEP/NCAR) reanalysis: http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis.html
2. Local sea level/tide stations:
    1. Data available from the NOAA Tides and Currents web page: http://tidesandcurrents.noaa.gov/
3. Local streamflow data:
    1. Dataset available from the United States Geological Survey: http://waterdata.usgs.gov/ak/nwis/
4. Large-scale climate system indices:
    1. Pacific Decadal Oscillation (PDO): http://jisao.washington.edu/pdo/PDO.latest
    2. Southern Oscillation Index: www.cgd.ucar.edu/cas/catalog/climind/index.html

3. North Pacific Index (NPI): www.cgd.ucar.edu/cas/catalog/climind/index.html
4. Pacific-North American Index (PNA): http://jisao.washington.edu/data/pna/

5 Content of Results Section (iv): Comparison of Glacier Bay Measurements to Other Surface and Profile Data

Evaluation of the Glacier Bay CTD data within a broader spatial context can be accomplished by using historical CTD casts from the greater Southeast Alaska region. Data can be downloaded from the NODC World Ocean Database (WOD) at http://www.nodc.noaa.gov/access/index.html. The plot shown in Figure SOP 15.2 is an example of using this WOD historical dataset. The WOD should be polled for each Five-Year Report to determine whether new casts for the region of interest have been incorporated. Transects that are coincident or nearly coincident with the timing of the Glacier Bay CTD transects should be focused on and will provide the greatest benefit for analysis.

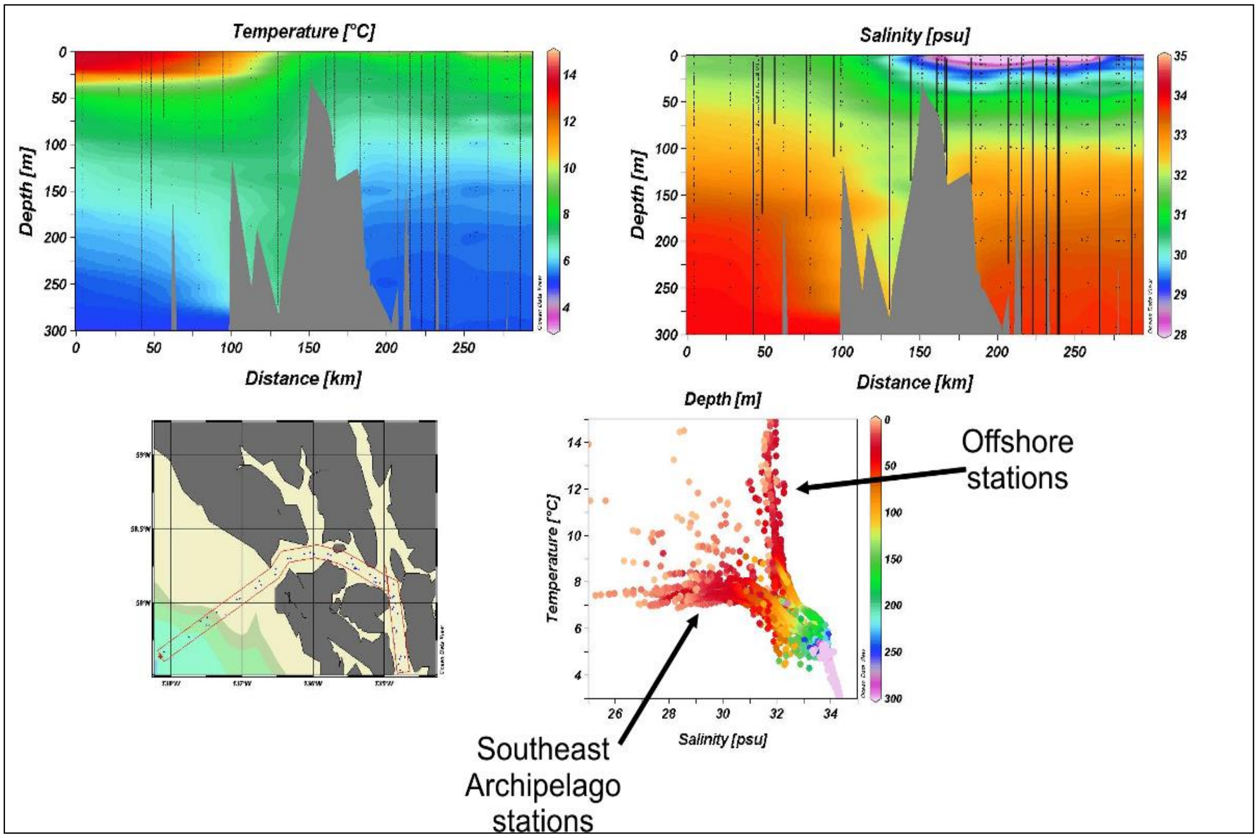


Figure SOP 15.2. Horizontal cross-sections (upper panels) and a temperature-salinity plot (lower right panel) employing historical CTD data from the NODC World Ocean Database, plotted with the Ocean Data View (ODV) software package. Station locations are plotted on the map in the lower left panel and span from the central Gulf of Alaska (located at 0 km on the left of the upper two panels) into Cross Sound (at approximately 110 km) to the mouth of Glacier Bay (at approximately 150 km), to the mouth of Lynn Canal (at approximately 220 km) and down into Chatham Strait. In this case, the data are averaged from between the months of August and October.

Other spatially explicit datasets that can lead to useful insight include satellite measurements of:

1. Sea surface temperature (advanced very high resolution radiometer satellite)
2. Winds
3. Sea surface elevation (from the Topex/Poseidon satellites)
4. Ocean color (SeaWifs and MODIS satellites)

These datasets can all be accessed online: http://seawifs.gsfc.nasa.gov/ and http://podaac.jpl.nasa.gov/DATA_CATALOG/index.html. Useful datasets can also be retrieved directly from the AOOS data portal: http://www.aoos.org/.

6 Validation and Submission of the Deliverable

The final version of OC_L is generated as a DOCX file by the Project Leader. It is passed to the Data Manager for processing as an NRTR by the NPS publications staff. Once the publications group approves the final product, the data manager creates a PDF file and performs the protocol-defined validation checks. Eventually the report is confirmed certified through the standard workflow described in Chapter 4. The Data Manager installs the final PDF in the auxiliary repository, creates a web link for it, updates the Deliverable Product Tracking grid, and forwards the final OC_L to NPS's IRMA Data Store.

SOP 16: Managing the Production Environment

Summary

In order for most SEAN deliverables to be disseminated to the public, they must be installed in the NPS Production environment at NRSS. Certain of the deliverables must also be installed in production repositories, such as the NODC and the NPS Data Store. In order for this production content to be generated, various steps must be performed in SEAN's Staging/Integration environment. Once content is built and verified in the Staging/Integration environment, it gets copied to Production for permanent storage and dissemination.

Most of the detailed SOPs in this protocol end with a reference to propagating the final deliverable into Production. This is an implicit reference to this SOP. Not all deliverables are handled in the exact same manner, so methods for installing them into Production vary.

Schematic of the Environments

Figure SOP 16.1 illustrates the major components in the SEAN Staging/Integration and NRSS Production environments. References are also made to SEAN's Development environment. Details of its operation are not germane to moving deliverables from Staging/Integration to Production and will not be discussed here. But be aware that all web files are originated in Development, deployed on Staging/Integration, and copied to Production.

Components of the Environments

Major components of the Staging/Integration environment include the Staging Directory, the Data Management website, the Staging Database, the Integration Auxiliary Repository, and the Integration website.

The staging directory is a folder on SEAN's local file server used to collect submitted products and feed them into validation and certification processes. It is currently located at \\sean.glba.nps.gov\data\SEAN_Data\Staging\OC\. Each deliverable has its own subdirectory, in which individual submissions are stored for validation and possible acceptance.

The data management website is an internal-only website holding applications used to validate some deliverables, create certain deliverables, report information used as the basis for other deliverables, and actively track the status of all deliverables in process. It currently resides on INPGLBAFS03 and responds to DNS name sean-dm.glba.nps.gov. Only internal NPS users may access the data management website, and they must separately log in to it when their session first opens.

The staging database is an SQL Server 2008 Standard Edition database used to hold the OC_D product and the status tables. It currently resides on INPGLBAFS05 and its connection string name is SEAN_Staging_2008. The oceanography objects reside in schema OC.

The integration auxiliary repository is a set of folders and files within the integration website. It contains all certified deliverables except for OC_D, which can only live on a database server. It currently resides on INPGLBAFS03 and responds to DNS name sean.glba.nps.gov. Anyone within the internal NPS network may access it for reading. Only SEAN staff have permission to update files in the integration auxiliary repository.

The Production environment consists of the Production database, the Replica Auxiliary Repository, and the Production website. The Production database houses all final OC_D data, which it obtains by periodic restoration from a copy of the staging database. The Replica Auxiliary Repository is a mirror of the Staging Auxiliary Repository, which is updated by copying from the Integration Auxiliary Repository. The Production web server houses the public dissemination point. It draws content from the other two components.

Two additional Production environments, which receive copies of certain items from the Auxiliary Repository, are NODC and the NPS Data Store. Delivering content to these repositories is SEAN's only role and responsibility in their management.

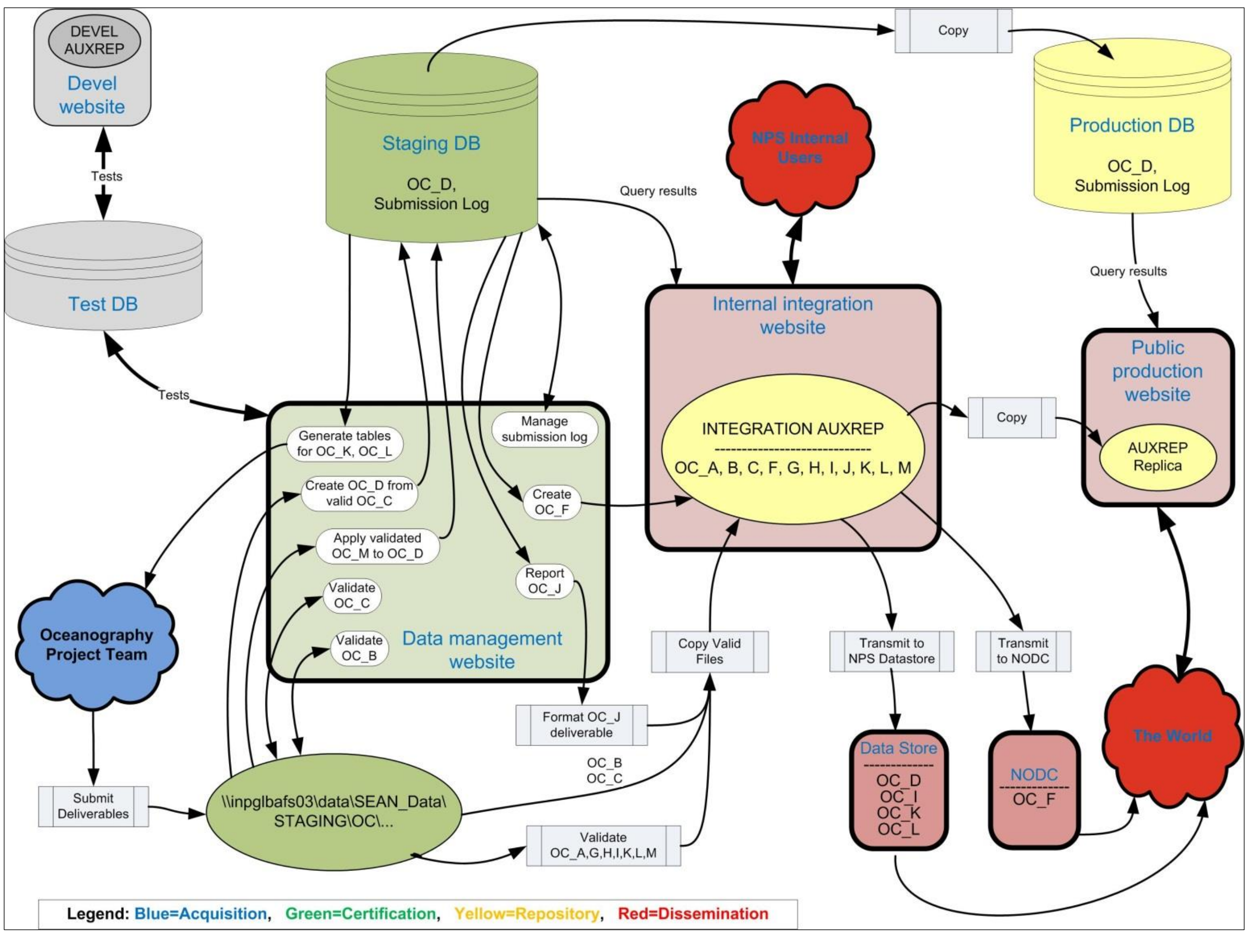


Figure SOP 16.1. Components of the Staging/Integration and Production environments are illustrated in schematic form. Coloring indicates the functional realm of each component, as defined in the SEAN data management plan. Gray rectangles depict the data management tasks required to move a product from one component to the next. Internal functions provided by the data management web server related to oceanography are also listed.

Management Tasks to Perform

Figure SOP 16.1 shows in rectangles the specific tasks needed to move a deliverable from the submission-to-staging through the production-dissemination states. These are primarily data copying steps achieved either by file transfer or by SQL database synchronization. No attempt will be made to detail specific commands and IT processes to accomplish these particular tasks. They are inherently complex and are dependent on the current complement of equipment components, software versions, security policies, and NRSS operating procedures. Most of the tasks are also performed on the order of only once per year. Data management staff are expected to determine the best method to use at each particular iteration.

The data management website also supports a number of necessary tasks required in accomplishing the staging to production process. These are depicted in Figure SOP 16.1 as rounded boxes within the data management website object. Their use is covered in the various SOPs that detail producing data deliverables.

SOP 17: NODC Data Submission (OC_F Creation)

Summary

At the end of each season, once the OC_D database updates and the OC_M quality assessment have been certified, the year's data are submitted to the NODC (http://www.nodc.noaa.gov/) for archiving and dissemination. The format of these submissions is straight comma-separated value.

All tasks are performed by the Data Manager.

Detailed steps

1. Open a new submission
    1. Use the Update Submission Log web tool on the NPS network at http://sean-dm.glba.nps.gov/0_submission_update.aspx.
    2. Complete Submission_Log details up through the Submission_Date column.
    3. Create a new directory in the staging area at \\sean.glba.nps.gov\data\SEAN_Data\Staging\OC\OC_F\NNNN where NNNN is the submission number.
2. Generate the data file in the staging directory using the database browser tool in the Integration website.
    1. Be sure the integration website has both OC_D and OC_M certified for the most recent year.
    2. Use the integration OC_MAIN.ASPX page, Original Source Data tab, Database Query and Download link.
    3. Select *all* years.
    4. Check box for "Include comments."
    5. Don't limit the selection filters in any way—all data must be downloaded.
    6. Press the button for "Save Results to…" Specify the staging directory and use the filename SEAN_OC_1993-YYYY.CSV, where YYYY is the most recent year covered in the data.
    7. Open the file with Excel or other software and verify the file was populated properly. Do not attempt to edit or save this file—NODC expects it to be pristine.
3. Revise the NODC Electronic Data Description form, our current medium of metadata reporting.
    1. Locate the EDDF.PDF form in the staging area that corresponds to the most recent submission and copy it to the new staging directory with a name that reflects the years covered (e.g., SEAN_EDDF_1993-2013.pdf).
    2. Edit in significant changes, typically the data series ending date.
    3. In the event the EDDF is no longer available, one may be created from scratch using the template at http://www.nodc.noaa.gov/General/NODC-Submit/dirsubmit_eddf.html.
4. Create a zip package for the NODC product.
    1. Create any other documentation that would help users understand the data.
    2. Package the data and metadata files within one compressed zip file in the staging area.
    3. Be sure to include all files you specified in the EDDF.PDF form.

5. Submit the package to NODC.
    1. Note that the latest documentation on this process may be found at http://www.nodc.noaa.gov/submit/index.html.
    2. Browse to http://www.nodc.noaa.gov/.
    3. Click on the "Submit Data" hyperlink for FTP data submission instructions.
    4. Upload data file and metadata file via FTP:
        1. Open an FTP communications program.
        2. Connect to "ftp.nodc.noaa.gov"
        3. When prompted for name, enter "anonymous" (use lower case).
        4. When prompted for password, enter your email address.
        5. When logged on, change directory to "incoming" by entering: "cd pub/incoming"
        6. Verify the correct directory (pub/incoming) by entering the command "pwd" (print working directory).
        7. Make sure the transfer type is binary by entering "bin"
        8. Use "put filename" where "filename" is the full path and name of the ZIP file.
        9. After completion of file transmission, enter "ls" to obtain a list of files that were sent (both by SEAN and other recent data submitters).
        10. Enter "bye" to log off.
    5. Send an email message to NODC.DataOfficer@noaa.gov to let them know that data was submitted. Describe the exact submission procedures and anything else they should know about the data.
    6. When the NODC acknowledges the submission:
        1. Update the submission log marking the submission status as Certified and provide the certification date.
        2. Update the OC_F column of the deliverable tracking sheet in the Development environment AUXREP and propagate it to Staging/Integration and Production.

SOP 18: Protocol Revision (OC_I Creation)

Summary

Periodically, material changes must be made to the protocol to take advantage of new or different technologies, equipment, and methods. Changes may also be made to support changed staffing levels, correct significant errors in the document, or redefine and update the forms of data products.

The program manager, project leader, and data manager jointly build a list of desired changes. They review the issues, accept some or all of them by consensus, and draft new language to affect the accepted changes. One person is chosen to coordinate the new document and be responsible for the new draft. Changes to major key items will trigger an external review of the draft document.

After satisfying both internal and, if judged necessary, external reviewers, the updated protocol will go through formal validation and certification by the program manager and data manager. The certified protocol will be widely disseminated.

Detailed Steps

1. Network Program Manager tasks
    1. Periodically poll Project Leader and Data Manager on the need for a protocol revision cycle. Schedule a revision cycle when called for by consensus.
    2. Obtain a new formal protocol ID number from Data Manager.
        1. Method for assigning a protocol ID is formally set in SEAN’s Data Management Plan, SOP-602 Version Control.
        2. A new ID is required for each revision because most data collected are tagged with the specific protocol they were created under: the mechanism is rigid by design.
    3. Solicit agenda of issues to address.
    4. Initiate kick-off meeting.
2. Program Manager, Project Leader, and Data Manager tasks
    1. Prepare issues lists.
    2. Agree on overall scope of revision.
        1. “Minor”
            1. Updates detailed processes and definitions.
            2. Requires internal review only.
        2. “Major”
            3. Updates purpose, objectives, or fundamental design.
            4. Requires out-of-network peer review.
    3. Agree on a coordinator who is responsible for managing assembly of the revised document.
    4. Obtain the most recent Word version of the current protocol from the Data Manager to serve as the basis for the new document.
        1. The original DOCX file is copied to an editable destination file.
        2. The document is set for tracked changes.
        3. A global search and replace is done to change all existing references to the protocol ID to the new designator.

        4. The DM provides a link allowing access of the DOCX file by the three team members through a browser.
        5. The actual final product will be published as an NRR report. It will be made available on the web as a read-only PDF in order to minimize the chance of multiple conflicting documents being built.
    5. Draft possible revisions.
        1. Each team member should take responsibility for sections within their realm of expertise.
        2. If a particular section needs to be addressed to meet multiple needs, it should be worked on serially instead of simultaneously.
            5. Get team agreement on the order of attack for issues.
            6. Assign person to do first revision covering first issue.
            7. Obtain consensus on the first revision.
            8. Assign person to do second revision covering second issue, etc.
3. Coordinator tasks
    1. Assemble revision drafts into a coherent document.
    2. Maintain a document change table in the SOP document to track internal versioning.
    3. Distribute to Program Manager, Project Leader, and Data Manager for internal review.
    4. Update document to satisfy internal review.
    5. Obtain consensus of Program Manager, Project Leader, and Data Manager.
    6. Rough format the document.
    7. Obtain team approval for final review draft.
4. Program Manager tasks
    1. If scope is major, coordinate external review.
        1. Pass document to regional I&M coordinator for consideration.
        2. Distribute resulting review comments to Program Manager, Project Leader, and Data Manager.
        3. Revise protocol in light of review comments.
        4. Coordinate revisions among team.
5. Coordinator tasks
    1. Format document as a natural resource report.
    2. Coordinate technical NRR review
    3. Obtain a TIC document number from NRSS.
    4. Make final technical revisions.
6. Program Manager tasks
    1. Generate a PDF file of the original Word document.
    2. Submit both the PDF and DOCX files via email attachment to the Data Manager for validation.
    1. Specify in the message body it is deliverable OC_I, as defined in protocol OC-2014.1.
7. Data Manager Tasks
    1. On receipt of the submission, assign the next formal submission number to this file, as found in the master Submission_Log table.

    1. Use the Update Submission Log web tool on the NPS network at http://sean-dm.glba.nps.gov/0_submission_update.aspx.
    2. Complete Submission_Log details up through the Submission_Date column.
  2. Save the attached files into the staging area for validation at \\sean.glba.nps.gov\data\SEAN_Data\Staging\OC\OC_I\NNN, where NNN is the submission number.
  3. Validate the two files according to current criteria.
  4. Record validation summary data in the Submission_Log using the web tool.
  5. If submission fails mandatory criteria, reply with a "failure email" that includes:
    1. The submission number assigned
    2. The deliverable ID
    3. The protocol ID
    4. Documentation listing all the specific mandatory criteria failed
  6. If submission passes mandatory criteria, reply with a "success email" that includes:
    1. The submission number assigned
    2. The deliverable ID
    3. The protocol ID
    4. Documentation listing any specific optional criteria failed
    5. Request to certify deliverable as complete
8. Program Manager tasks
9. On receipt of a failure email:
  1. Make corrections so the deliverable meets mandatory criteria.
  2. Make another submission with the corrected deliverable candidate.
10. On receipt of a success email, review any failed optional criteria:
  1. If these are acceptable to Program Manager, Project Leader, and Data Manager:
    1. Reply with a "certification email" stating the deliverable is certified and may be disseminated.
  2. If these are unacceptable:
    2. Reply with a "withdrawal email," stating the deliverable is withdrawn.
    3. Take remedial action to obtain a corrected deliverable.
    4. Restart the process from the beginning.
11. Data Manager tasks
  1. On receipt of a withdrawal email:
    1. Mark the withdrawal in the Submission_Log's Status column using the web tool.
    2. Terminate the process.
  2. On receipt of a certification email:
    1. Due to its nature, this deliverable contains no sensitive information.
    2. Copy the two submitted files to test environment at …AUXREP\OC\OC_I\.
    3. Name them PROTOCOL_ID.PDF and PROTOCOL_ID.DOCX where PROTOCOL_ID is the formal 9-character designator of the new protocol (e.g., OC_2014.1).
    4. Create web page link to the new PDF but not the .DOCX, which remains hidden.

    5. Present the old protocol's web page link as demoted.
    6. Mark the certification in the Status column in Submission_Log using the web tool.
    7. Propagate from test to Production environment.
    8. Update the annual deliverable tracking spreadsheet showing date of completion for OC_I. Note: not all tasks are necessarily done in the same calendar year.
3. Ensure the final document is uploaded to IRMA Data Store and reference is complete. Link it to the Oceanography project.
4. Revise websites to accommodate any altered information structure set in the new protocol.
5. Update the Staging database table SEAN.TBL_PROTOCOL to include new protocol and citation; propagate to Production database.

Appendix A. Oceanographic Station Locations

A.1 Currently sampled stations

Core stations are highlighted in **bold type**.

Station	Latitude (WGS84)	Longitude (WGS84)	Description	Nominal Depth (m)
0	58.326735	-135.875108	Icy Strait	53
1	**58.412562**	**-135.99511**	**Mouth of Glacier Bay**	**62**
2	58.490056	-136.05178	Sitakaday Narrows	93
3	58.571715	-136.065116	SE of Willoughby Island	112
4	**58.650872**	**-136.115113**	**N of Drake I. and N of Marble I.**	**288**
5	58.704199	-136.233473	Between N Drake and SW Tlingit Pt.	366
6	58.759193	-136.341762	E of Hugh Miller Inlet	288
7	**58.8111687**	**-136.474331**	**N of Blue Mouse, W of Tidal Inlet**	**435**
8	58.865018	-136.593433	S of Rendu Inlet	426
9	58.897515	-136.736769	SE of Russell Island	377
10	58.899179	-136.840103	N of Reid Inlet	361
11	58.972079	-136.916778	Tarr Inlet	338
12	**59.033341**	**-137.018446**	**Head of Tarr Inlet**	**288**
13	**58.73253**	**-136.113453**	**SE of Tlingit Pt., NW of Sturgess**	**146**
14	58.79169	-136.108456	Muir Sill	81
16	**58.895845**	**-136.093461**	**E of Hunter Cove**	**313**
17	58.975001	-136.136797	E of Westdahl Pt.	212
18	59.0500003	-136.18513	S of Riggs, NW of McBride	214
19	59.07168	-136.336789	Muir Inlet	225
20	**59.086017**	**-136.370953**	**Head of Muir Inlet**	**179**
21	59.047695	-137.057739	Marjorie/Grand Pacific	195
24	**58.333333**	**-136.116667**	**North Passage**	**150**

A.2 Historical stations not currently sampled

Station	Latitude (WGS84)	Longitude (WGS84)	Description	Nominal Depth (m)
15	58.815021	-136.105123	W of Muir Pt.	116
22	58.657692	-136.36543	Entrance to Geikie	155
23	58.598125	-136.506455	Head of Geikie	66

Appendix B. Standard Form Templates

Electronic copies of all templates are available using the "Toolbox" link on http://science.nature.nps.gov/im/units/sean/OC_Main.aspx

B.1 Field Log Sheet

Oceanographic Survey Field Log
Glacier Bay National Park and Preserve

Vessel: ________________________ **Cruise:** ________________________________ **Page** ___/___

CTD #: ____ **Data Dump #** _________ **Observer(s):** ____

Cast #	Station	Latitude (ºN)	Longitude (ºW)	Waypt.	GMT Date (YYYY/MM/DD)	GMT Time (HH:MM)	Fathometer Depth (m)	Target Depth (m)	Comments
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			
		___.______	-____.______		____/___/___	___:___			

Notes:

B.2 CTD Download Checklist

Oceanographic Survey CTD Download Checklist
Glacier Bay National Park and Preserve

Date: ___________________ **CTD #:** _____ **Data Dump #** _________

Cast #	Starting record	Ending record	File name	Down-loaded ✓	Visual Inspection ✓
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐

File name is 18 characters of the form **yymm_C_dddd_cc.HEX** where:
yy is year, **mm** is month, **C** is CTD#, **dddd** is dump#, **cc** is cast#
(use leading zeroes where necessary to meet length requirements)

B.3 Data Quality Report

Oceanographic Survey Data Quality Report
Glacier Bay National Park and Preserve

CTD #: ____ Data Dump # ________ Starting Date: ________________

Cast#	Quality Code	Comment	Cond	Temp	Fluo	OBS	PAR	O2
			Disqualified Sensors					
All Casts in Dump			☐	☐	☐	☐	☐	☐
		- OR -						
00			☐	☐	☐	☐	☐	☐
01			☐	☐	☐	☐	☐	☐
02			☐	☐	☐	☐	☐	☐
03			☐	☐	☐	☐	☐	☐
04			☐	☐	☐	☐	☐	☐
05			☐	☐	☐	☐	☐	☐
06			☐	☐	☐	☐	☐	☐
07			☐	☐	☐	☐	☐	☐
08			☐	☐	☐	☐	☐	☐
09			☐	☐	☐	☐	☐	☐
10			☐	☐	☐	☐	☐	☐
11			☐	☐	☐	☐	☐	☐
12			☐	☐	☐	☐	☐	☐
13			☐	☐	☐	☐	☐	☐
14			☐	☐	☐	☐	☐	☐
15			☐	☐	☐	☐	☐	☐
16			☐	☐	☐	☐	☐	☐
17			☐	☐	☐	☐	☐	☐
18			☐	☐	☐	☐	☐	☐
19			☐	☐	☐	☐	☐	☐
20			☐	☐	☐	☐	☐	☐
21			☐	☐	☐	☐	☐	☐
22			☐	☐	☐	☐	☐	☐
23			☐	☐	☐	☐	☐	☐
24			☐	☐	☐	☐	☐	☐

Data quality codes are:
0 - good 1 - unknown 2 - questionable 8 - bad
as defined for Ocean Data View at http://odv.awi.de/fileadmin/user_upload/odv/misc/ODV4_QualityFlagSets.pdf.

Disqualified sensors are either those disconnected from the instrument or those, after cast data are reviewed, determined to be giving invalid readings. Checking the sensor's disqualify box will cause the OC_D database to have its values made NULL for the indicated cast(s).

Deliverable OC_M reporting sheet, revised 12/13/2010

Template

Appendix C. Oceanographic Survey Equipment List

C.1 Research Vessel and Support Equipment

- R/V *Fog Lark* or *Capelin*
- Power block/davit (on boat)
- Hydraulics (on boat)

C.2 CTD Sampling Equipment

- SEACAT Conductivity-Temperature-Depth (CTD) recorder
- Ground line (marked every 10 m) and plastic tub
- two stainless steel locking carabineers (on CTD)
- CTD equipment box
  - Distilled water squirt bottle
  - Triton–X* detergent and squirt bottle with diluted solution and material data safety sheet (MSDS)
  - Silicone grease (Dow Corning 4 electrical insulating compound)
  - Rubbing alcohol and Q-Tips (for cleaning conductivity cell and data cable pins)
  - Lint-free cloth and lint-free papers (KimWipes)
  - Data cable, including RS232 to DB9 connector
  - Copy of protocol
  - Spare pens and pencils
  - Paper towels
  - Spare batteries
    - 9 D-cell batteries (per CTD)
    - 12 AA-cell batteries (four per GPS, eight per precision lightweight GPS receiver [PLGR])
- Distilled water (1gallon)
- Office box (containing general office equipment)
- GPS unit and manual (be sure to download station locations into GPS before use.)
- Extra power and antenna cables and external antennas
- Stopwatch with timer alarm

* Triton X-100 is nonionic detergent, which is used as a 1% solution in distilled water. One source is VWR Scientific Products in Seattle, WA at 800-932-5000, or www.vwrsp.com.

C.3 Manuals and Documentation

- Seacat SBE CTD, SeaSave, SeaPlot, and SBE Data Processing operating manuals
- GPS operating manual
- Last CTD dump number
- Waterproof field notebook with blank Rite in the Rain or Duracopy paper
- Oceanography notebook (contains protocol, station locations, maintenance information, etc.)
- Field log forms copied onto waterproof paper
- Download checklist forms copied onto waterproof paper

C.4 General Field Gear

- Rite in the Rain waterproof or DuraCopy plastic paper
- Several black ultra-fine point Sharpie pens and/or pencils
- Personal flotation devices (one per person on board)
- Immersion (survival) suits (one per person on board)
- Handheld (waterproof) radio with ParkNet frequencies and extra radio batteries
- Rain gear
- Waterproof gloves (insulated ideal)
- Waterproof steel-toed boots
- Binoculars
- Topographical map and nautical charts of Glacier Bay
- Digital camera
- Groceries: order beforehand
- Personal gear

C.5 Computer Equipment and Software

- On-board Windows laptop with appropriate ports for connection to CTD
- Computer power supply and charger
- SeaTerm.exe CTD data acquisition software
- WordPad, Notepad, or other text editor software
- Thumb drive backup device

Appendix D. List of Acronyms

Acronym	Definition
ARCC	Alaska Region Communications Center
AUV	autonomous underwater vehicle
DFO	Canadian Department of Fisheries and Ocean Sciences
CTD	conductivity-temperature-depth instrument used for recording oceanographic parameters
CO-OPS	Center for Operational Oceanographic Products and Services
DO	dissolved oxygen
ENSO	El Nino Southern Oscillation
FGDC	Federal Geographic Data Committee
GLBA	Glacier Bay National Park and Preserve
GMT	Greenwich mean time
GPS	global positioning system
GRS	geographic response strategies
I&M	National Park Service Inventory and Monitoring Division
IOS	Institute of Ocean Sciences at the Canadian Department of Fisheries and Ocean Sciences
IPCC	Intergovernmental Panel on Climate Change
IRMA	Integrated Resource Management Applications
MSDS	material data safety sheet
NCAR	National Center for Atmospheric Research
NCDC	National Climate Data Center
NDBC	National Data Buoy Center
NCEP	National Center for Environmental Prediction
NOAA	National Oceanic and Atmospheric Administration
NODC	National Oceanographic Data Center
NOS	National Ocean Service
NPS	National Park Service
NRR	Natural Resource Report
NRSS	Natural Resource Stewardship and Science branch of National Park Service
NRTR	Natural Resource Technical Report
OBS	optical backscatterance, a measure of turbidity
ODV	Ocean Data View visualization software
PAR	photosynthetically active radiation
PDO	Pacific decadal oscillation
PNA	Pacific-North American index
PSU	practical salinity unit
QA	quality assurance
RMA	returned materials authorization
SBE	Sea-Bird Electronics

Acronym	Definition
SEAN	Southeast Alaska Network of NPS Inventory and Monitoring Division
SOP	Standard operating procedure
SQL	structured query language
USCG	United States Coast Guard
USGS	United States Geological Survey
WAN	wide area network
WOD	World Ocean Databas

Appendix E. Safety Documentation

E.1 General Safety Plan
R/V *Fog Lark* Oceanographic Monitoring

(July 2013)

********** Much of the below applies to ALL *Fog Lark* operations **********

Communications

- Prior to departure, file float plan with visitor information station (VIS), rangers, or Denali Dispatch (700). Arrange expectations for periodic or daily check-ins and updates according to the policies currently in effect for backcountry communications. Arrange for SPOT following.
- Equipment: base park radio, base marine VHF radio, handheld marine VHF radio, EPIRB (category I, 406/121.5 MHz, externally mounted, float-free, automatically activated), SPOT device.
- If desired, more advanced tracking devices (e.g., Spidertracks) and/or a satellite telephone may be available for use if desired and with advance planning.

Vessel Equipment (including all items in accordance with the Glacier Bay Boating Policy)

- Radios (see above), EPIRB, SPOT device
- GPS chart plotter, paper charts, fathometer, radar. Portable GPS.
- Survival suits (four universal, two oversize) with strobes and whistles, easily accessible
- Six float coats, range of sizes, with strobes and whistles
- Six float vests, range of sizes, with strobes and whistles
- Two to four type IV throwable boat cushions (also fenders, etc.)
- Extendable boat hook (to reach someone in the water, fend off icebergs, etc.)
- One throwable life ring (ring buoy)
- One throw bag
- Inflatable on roof, oars, kicker
- Two bulkhead-mounted fire extinguishers
- Flare kit
- First aid kit
- Portable air horn
- Anchors and/or sea anchor
- Emergency food and water

Vessel Operations

- All operations in accordance with the Glacier Bay Boating Policy (e.g., operator certification and restrictions, use of navigation equipment, navigation lights) and DOI Watercraft Policy 485 DM 22, August 2011 update
- PFDs worn on deck; operator knows locations of all personnel at all times
- Operations are conservative regarding environmental conditions

- Importance of operator (and participant) situational awareness and thinking ahead is stressed
- General "safety-before-all-else" attitude. Maintain perspective. When in doubt, stop and breathe deep.

Special Equipment/Project Operations

- Job hazard analysis (JHA) for instrument package deployment via power davit
- Mindful of any chemicals (MSDS) or other hazards
- Mindful of any additional necessary PPE or operational safety behavior

Safety Briefing

- At the beginning of each trip and whenever plans are significantly altered
- Equipment (see above), communications (including Mayday) and signaling, man overboard, fire, abandon ship. General safe behavior on deck.
- Communicate: speak up
- Operations of the day. Any hazards specific to current mission (see above).

General

- Resist gear accumulation over time; maintain a clear deck and house
- Regular preventive maintenance
- Alertness to ways to improve safety (equipment, operations, behavior)
- Report any accidents or near misses to the park boating officer and the park safety officer

Emergency Contacts

Visitor information station (VIS) or any ranger
Hail on park radio "Bartlett Cove" or on marine VHF radio "KWM20 Bartlett Cove"; work phone 907-697-2627

Park Boating Officer
Gus Martinez (GLBA radio #210; work phone 907-697-2628)

Park Safety Officer
Jake Ohlson (GLBA radio #603; work phone 907-697-2602)

Resource Management Division Chief
Lisa Etherington (GLBA radio #300; work phone 907-697-2640)

Park Marine Mechanic
Bruce McDonough (GLBA radio #621; work phone 907-697-2639)

Fog Lark Vessel Steward
Mike Bower, program manager, Southeast Alaska I&M Network (GLBA radio #360; work phone 907-364-2621)

National Weather Service (for marine weather conditions and forecasts)
Phone 907-790-6800 to speak with a live forecaster.

U.S. Coast Guard
Hail on marine VHF channel 16; phone 800-478-5555.

E.2 Job Hazard Analysis

JOB HAZARD ANALYSIS (JHA)		Date: 3/09/2012	New JHA Revised JHA
Park Unit: GLBA	Division: Resource Management	Branch: Oceanographic Monitoring	Location: GLBA marine research vessels
Job Title: Deploying oceanographic monitoring gear (CTD/rosette water sampler, hydraulics)		JHA Number:	Page 1 of 2
Job Performed By: GLBA resource management, NPS inventory and monitoring, external researchers, other NPS staff, volunteers	Analysis By: Chris Sergeant, Lewis Sharman, Brendan Moynahan	Supervisor: Lewis Sharman	Approved By:

Required Standards and General Notes:	All employees performing this task should be familiar with the Park Boating Policy, the Oceanographic Monitoring General Safety Plan, and this JHA. This job requires reasonable wind and sea conditions (<20 knots; <3 ft. waves) and a minimum of two people. Consider employee physical fitness level for lifting and moving heavy gear.
Required Personal Protective Equipment:	PFD, work gloves, steel-toed boots, and hearing protection; pocket knife; raingear and warm clothing, as appropriate
Tools and Equipment:	Research vessel davit, hydraulic winch, small engine for hydraulics, oceanographic CTD and rosette sampler, tub of line

Sequence of Job Steps	Potential Hazards/Injury sources	Safe Action or Procedure
1. Move CTD/rosette (sampler) and tub of line between dock and vessel deck. 2. Organize gear on deck; connect hydraulic system and train of oceanographic sampling gear. 3. Deploy sampler by raising off deck with winch, rotating davit across gunwale, lowering into water, continuing to target depth. 4. Recover sampler by raising from depth with winch, bringing out of water, rotating davit across gunwale, lowering to deck. 5. Each sampling station repeats steps three and four.	For all steps: 1. SB: sampler (mainly a danger to feet when lowering) 2. Fall into water 3. O: due to weight of sampler 4. CO: sampler/line/hydraulic block 5. CB: sampler and gunwales 6. FS/SA: trip over line or hydraulic hoses 7. E: hearing damage from noise of small engine powering hydraulics	1. Load only with assistance from at least one co-worker; use appropriate PPE; communicate moving plan before lifting sampler; clear any obstacles from moving path; mind fingers and hands; keep feet clear of drop area. 2. Wear PFD whenever on deck; do not shift center of gravity over water; keep body clear of rope bight or path of travel; beware hydraulic hoses and puller (trip hazards). 3. Lift using legs and with assistance; avoid moving at awkward angles. 4. Do not wear loose clothing around deck gear; keep body clear of sampler during transfer between deck and water; keep all body parts clear of rope bight; keep hands well clear of sheave; person controlling hydraulics continuously alert to juxtaposition of coiler (person), line, sheave, and sampler; wear gloves. 5. Do not position between gunwale and sampler. 6. Keep deck tidy, no loose lines/hoses, watch footing. 7. Wear hearing protection.

Common Injury Sources: SB= Struck By, SA = Struck Against, CBY = Contacted By, CI = Caught In, CB = Caught Between, CO = Caught On, FB = Fall to Below, CW = Contacted With, O = Overexertion or Repetitive Motion, FS = Fall at the Same Level, BR = Bodily reaction, E = Exposure to Chemical, Noise etc.

Approved by: ________________________________ Date: _______________________

E.3 GLBA Back Country Communications Plan

GLBA BACKCOUNTRY COMMUNICATIONS PLAN

Approved: ____

Susan L. Boudreau
Superintendent, Glacier Bay National Park and Preserve

Effective date: 4/15/2014

This plan is in effect immediately and will remain in effect until superseded or cancelled.

Contents

1 Applicability

This plan applies to all Glacier Bay National Park and Preserve (GLBA) employees, volunteers, visiting National Park Service (NPS) employees, and nonemployees (such as some contractors) whose daily work is supervised by an NPS employee. In this plan, all of these user groups combined are referred to as "employees."

2 Definition of Backcountry Operations

For the purpose of this plan, backcountry operations include any on-duty operation meeting any of the following criteria:

Aviation

- All "special use" flights (as outlined in the Park Aviation Plan) including any flight to or from Dry Bay.

Motor Vehicle Use

- Any form of motorized transport in the preserve that is outside of the Dry Bay Camp Area (Figure 1)

Boating

- All motorboat operations *except* by cruise ship, tour boat, or by charter or collaborator vessel under a boater permit
- All nonmotorized boat operations

Hiking

- All hikes in the park that are outside of the Bartlett Cove Developed Area (Figure 2)
- All hikes, including any form of non-motorized transport, in the preserve that are outside of the Dry Bay Camp Area

Camping

- All overnight camping in the park outside of the Bartlett Cove developed area
- All overnight camping in the preserve outside of the Dry Bay camp area

3. Required Communication Devices

An effective means of communication is necessary whenever working in or traveling into the backcountry. At the minimum, each group of two or more employees is required to carry at least two portable park radios or have available a satellite phone or stationary radio. Employees working or traveling solo are required to carry one park radio or satellite phone. All other means of communication (SPOT devices, SpyderTrack devices, etc.) are considered to be in addition to but not a replacement for a park radio or satellite phone.

4. Dispatch Centers

Communication with a dispatch center is a key element of all safe backcountry operations. GLBA backcountry communications are routed through the Bartlett Cove Visitor Information Station (VIS) or the NPS Alaska Region Communications Center (ARCC), depending on time of year and time of day.

VIS:

Radio: "KWM20 Bartlett Cove" (the VIS monitors VHF channels 12 and 16)
Phone: (907) 697-2627
Alternate (ranger on duty): (907) 697-2632
Email: glba_visitor_contact_station@nps.gov
In person: head of Bartlett Cove public use dock

The VIS is responsible for dispatch at the following times:

May 1–May 31	8 am to 5 pm
June 1–Aug. 30	7 am to 7 pm
Sept. 1–Sept. 30	8 am to 5 pm

For all other dates and times, dispatch is routed through the ARCC.

ARCC:

Radio: "700" (the ARCC monitors Bartlett Cove VHF ParkNet channel 2 "BearTrack" and Yakutat VHF ParkNet channel 2 "Deception Hills")
Phone: (907) 683-9555
Alternate (cellphone): (907) 378-5751
Satellite phone: 8816-3145-8390
Email: dena_commcenter@nps.gov

5. Three-step Communications Process

The approved process for employee backcountry communications includes three steps: (1) filing a written backcountry travel plan, (2) checking in and out of service, and (3) making predetermined status checks.

Backcountry Travel Plan

Prior to traveling into the backcountry, each employee or group of employees traveling together is required to file a written Backcountry Travel Plan with the dispatch center that is in service at the time the trip is to begin.

There are three standard Backcountry Travel Plans in use at GLBA:

- **Backcountry Itinerary** (Appendix A) required for all qualifying hikes, camping, and travel by motorized vehicle such as ATV or UTV.
- **Float Plan** (Appendix B) required for all qualifying boating operations
- **Flight Plan** (Appendix C) required for all qualifying flights

Current Backcountry Travel Plan forms can be found at https://sites.google.com/a/nps.gov/arcc-region/home/documents

If traveling or working in a group of two or more, only one plan is required for the group. If persons within the group split up, a deviation to the Plan must be reported to the dispatch center.

On any single trip that includes more than one means of transportation, multiple plans may be necessary.

Upon completion of a backcountry trip, it is essential that employees close out their Backcountry Travel Plan with the dispatch center as soon as possible. If you fail to do so, a time-intensive and costly search may ensue, perhaps placing other employees at risk.

Reporting In and Out of Service

All employees shall notify the dispatch center when entering or leaving the backcountry. This is called reporting in and reporting out, respectively. For employees overnighting in the backcountry, a call to dispatch is required each morning before 10 am to report into service. Employees overnighting in the backcountry must prearrange a daily reporting out time with dispatch.

Use of a radio or satellite phone is the preferable method for reporting in and out of service. In some cases, automatic SPOT updates will suffice for status checks, and manual notification by SPOT will fulfill daily in and out of service check-ins. This is allowed only when specifically requested in a Backcountry Travel Plan.

Status Checks

In addition to reporting in and out of service, employees working or traveling in the backcountry are required to check-in with the dispatch center at time intervals determined by the method of travel (Table 1). More frequent status checks are left to the discretion of the employee and/or their supervisor. It is the employee's responsibility to initiate their own status checks.

Status checks are usually accomplished by calling in to a dispatch center via radio or satellite phone. In some cases, the use of an automatically updating SPOT device will relieve this requirement. In other cases, the use of both a radio or satellite phone and a SPOT device are required (Table 1).

Deviations from Route or Schedule

All deviations to travel plans must be reported to the park communications center prior to the deviation or immediately upon discovering the deviation.

Table 1. Frequency of Required Status Checks

Travel Method	**Qualifying Backcountry Operation**	**Status Check Frequency** ***(minimum, in addition to daily reports in and out of service calls)***
Air	All "special use" flights (as outlined in the Park Aviation Plan), including any flight to or from Dry Bay.	Every 30 minutes by radio or satellite phone ***and*** every 15 minutes automatically by Spydertrack
Motor Vehicle	Any form of motorized transport in the Preserve but outside of the Dry Bay Camp Area	Every four hours by radio or satellite phone ***or*** every 30 minutes automatically by SPOT device
Motorboat	All motorboat operations ***except*** by cruise ship, tour boat, or by charter or collaborator vessel under a boater permit.	Every four hours by radio or satellite phone ***or*** every 30 minutes automatically by SPOT device or Automatic Identification System (AIS)
Nonmotorized boat	All nonmotorized boat operations (see "Exception to check-ins" below).	Every four hours by radio or satellite phone ***or*** every 30 minutes automatically by SPOT device
Hike off trail system*	All hikes beyond the Bartlett Cove developed area or Dry Bay camp area, including transport by any nonmotorized means or overnight camping	Every four hours by radio or satellite phone ***or*** every 30 minutes automatically by SPOT device
Hike on trail system	All hikes on a developed trail outside of the Bartlett Cove developed area or the Dry Bay camp area	Report in and out of service only
Hazardous operations	All hazardous activities outside of the Bartlett Cove developed area or the Dry Bay camp area (see "Hazardous operations" below).	Additional check-ins to be determined by a risk assessment

Exception to check-ins through a dispatch center for hikes or travel by nonmotorized boats when based out of a "mother ship"

Employees hiking or using nonmotorized boats may report in and out of service and accomplish status checks by reporting directly to a manned mother ship (motorboat or float house) that has its own active float plan and check-ins arranged with a dispatch center. This exception is only valid for instances when the manned mother ship remains within radio range of the employees for the entirety of their hike or nonmotorized boat trip. The frequency of check-ins will be the same as those accomplished through a dispatch center. The mother ship must be able to relay messages to and from a dispatch center, as needed, through the use of a radio or satellite phone. As far as the dispatch center is concerned, these employees are part of the mother ship's float plan.

Hazardous Operations

Each employee or group of employees involved in a high-risk operation shall base their check in frequency on a risk assessment of their task. High-risk activities include swift-water crossing, hazard tree removal, and emergency response operations. It is recommended that each group of employees engaged in a high risk activity assign one employee to monitor a radio at all times if safe to do so.

Off-Duty Services (nonmandatory)

Tracking services are available through a dispatch center for use by employees who are located in the backcountry for work even when that employee is off-duty. These services may be used, at the employee's option, when an employee has completed his or her workday and decides to hike for recreation.

6. Loss of Communication

Radio Coverage Dead Zones

Operations conducted in areas of suspected spotty radio coverage or radio-dead zones (Figure 3) require special precautions. To facilitate better operational control, personnel entering radio dead zones should contact dispatch prior to entering these areas and again upon exiting. Dispatch should be advised of the time of day that employees expect to enter radio dead zones and when they are expected to exit the dead zone. Use of alternative communication equipment, such as satellite phones, is encouraged to minimize or eliminate the amount of time employees are without radio contact capability.

Communication Equipment Failure

In the event of known communication equipment failure while in the backcountry, the employee has the responsibility to recognize that search efforts may follow and should attempt to intervene by exiting the backcountry, if safe to do so, along predicable routes as soon as possible or by locating another unit with good communication equipment (trail crew, etc.). Exiting the backcountry is preferred unless the exact location of the other unit is known and it can be reached in a timely manner.

7. Tracking and Response

Dispatch Tracking Procedure

Unless specifically requested, the dispatch center will not initiate status checks. The responsibility of the dispatch center is to track employee status checks and calls in and out of service and notify rangers if these calls have been missed. In cases where a backcountry traveler is still in the field when one dispatch center hands service over to the other, it is the responsibility of the first dispatch center to also transfer all relevant information on the traveler (such as hike plans, check-in times, etc.).

Initiation of a Response

If an employee fails to answer or initiate a status check, or fails to call out of service, the dispatch center will make three more attempts at five-minute intervals to make contact. If no contact is made, a dispatcher will notify the ranger on duty, district ranger, or chief ranger and the superintendent, in that order. Ranger staff will be responsible for initiating appropriate action that is intended to locate and ensure the safety of any employee who is unaccounted for. The ranger staff will gather all available information regarding the employee and their described route, plan, weather conditions, area hazards, and other information that will assist in determining an appropriate reaction or response (i.e., search urgency). Efforts to contact the employee will continue. Keep in mind that *the inability to contact an employee does not necessarily prompt an immediate or even delayed response*. This procedure shifts such decisions from a dispatcher to a supervisory park ranger and is consistent with the manner in which all backcountry overdue persons or parties are addressed in the park.

The employee's supervisor will be notified by ranger staff each time efforts are initiated to follow up on employees who fail to respond to status checks or fail to check out of service. In such events, the supervisor is required to notify his or her division chief.

8. Exceptions

Alternative communication procedures are permitted for law enforcement missions only as approved by the district ranger or chief ranger. These alternative procedures should still include reports into and out of service and regular status checks but may be accomplished by means other than through the dispatch center.

Any other exception from this policy must be preapproved by the superintendent in writing. Prior to the commencement of travel, the written superintendent-approved exception from policy must be submitted to the dispatch center along with the associated Backcountry Travel Plan.

9. Figures

1. Dry Bay Camp area map
2. Bartlett Cove developed area map
3. Radio coverage map (Glacier Bay proper)

10. Appendices

1. Backcountry Itinerary
2. Float Plan
3. Flight Plan

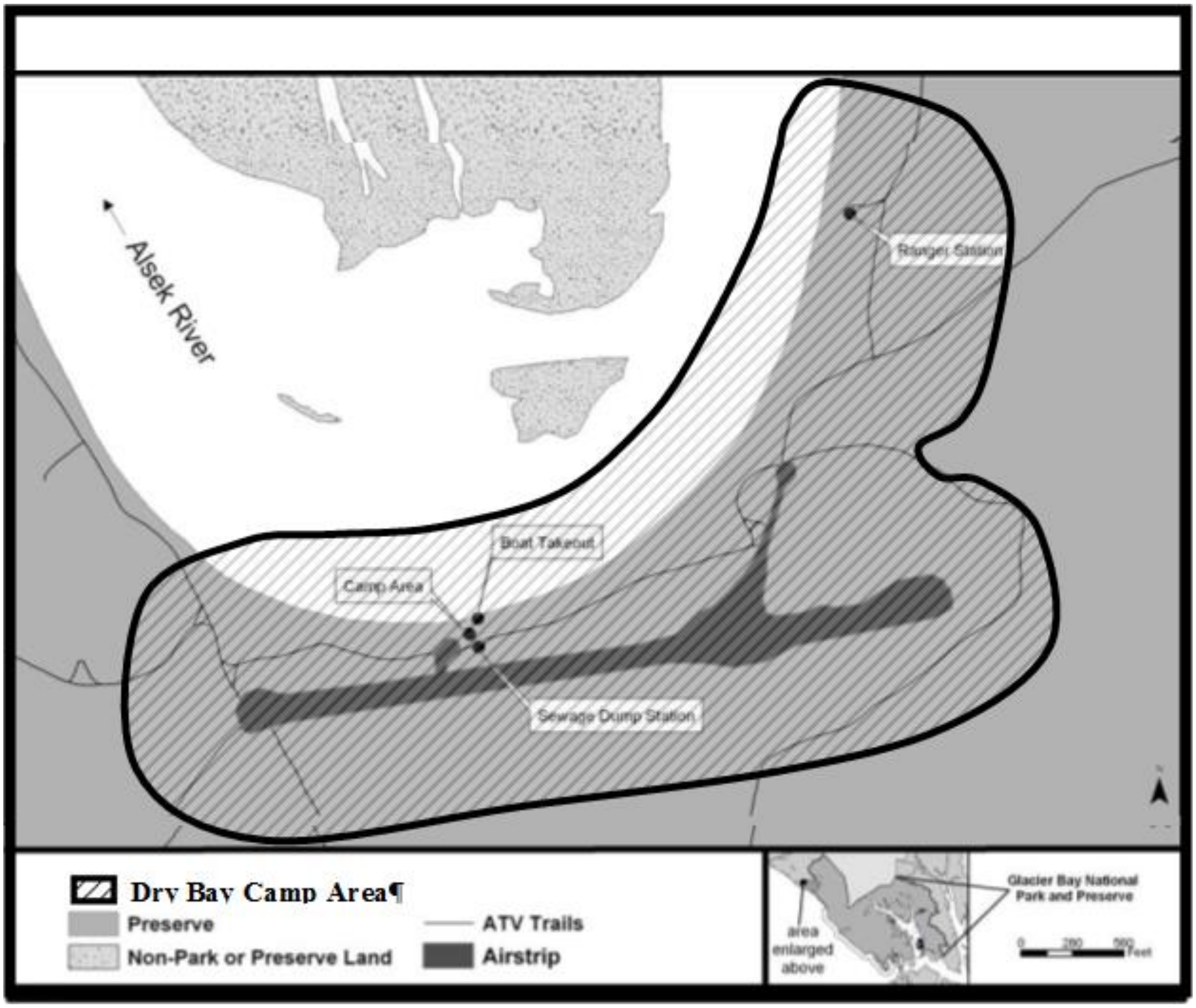


Figure 1. Dry Bay Camp area map.

Dry Bay Camp Area: For the purposes of this plan, the term Dry Bay camp area means all lands and waters within 500 feet of the Dry Bay Ranger Station complex, campground, boat takeout, airstrip, and the portion of ATV trails that connect these features.

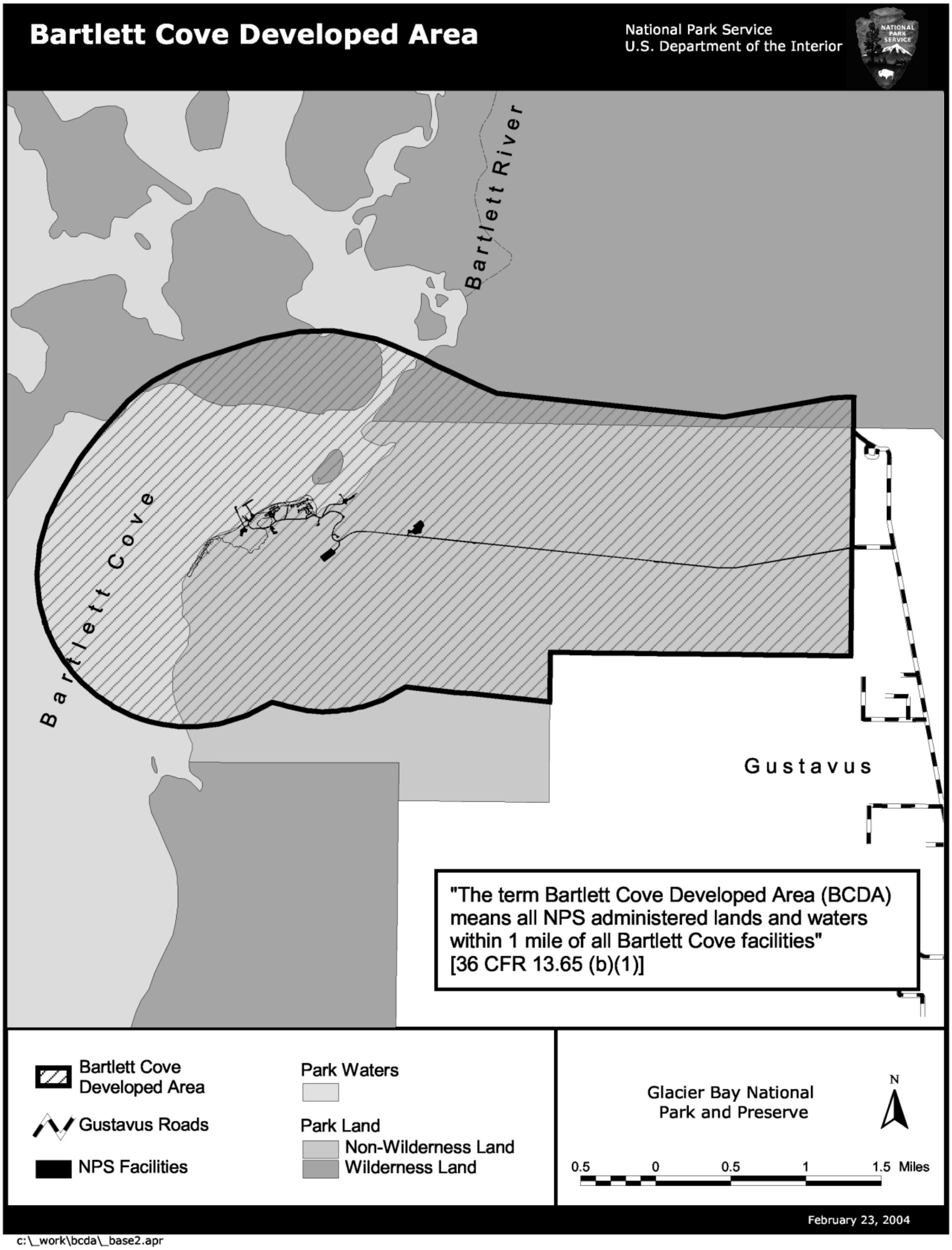


Figure 2. Bartlett Cove Developed Area Map.

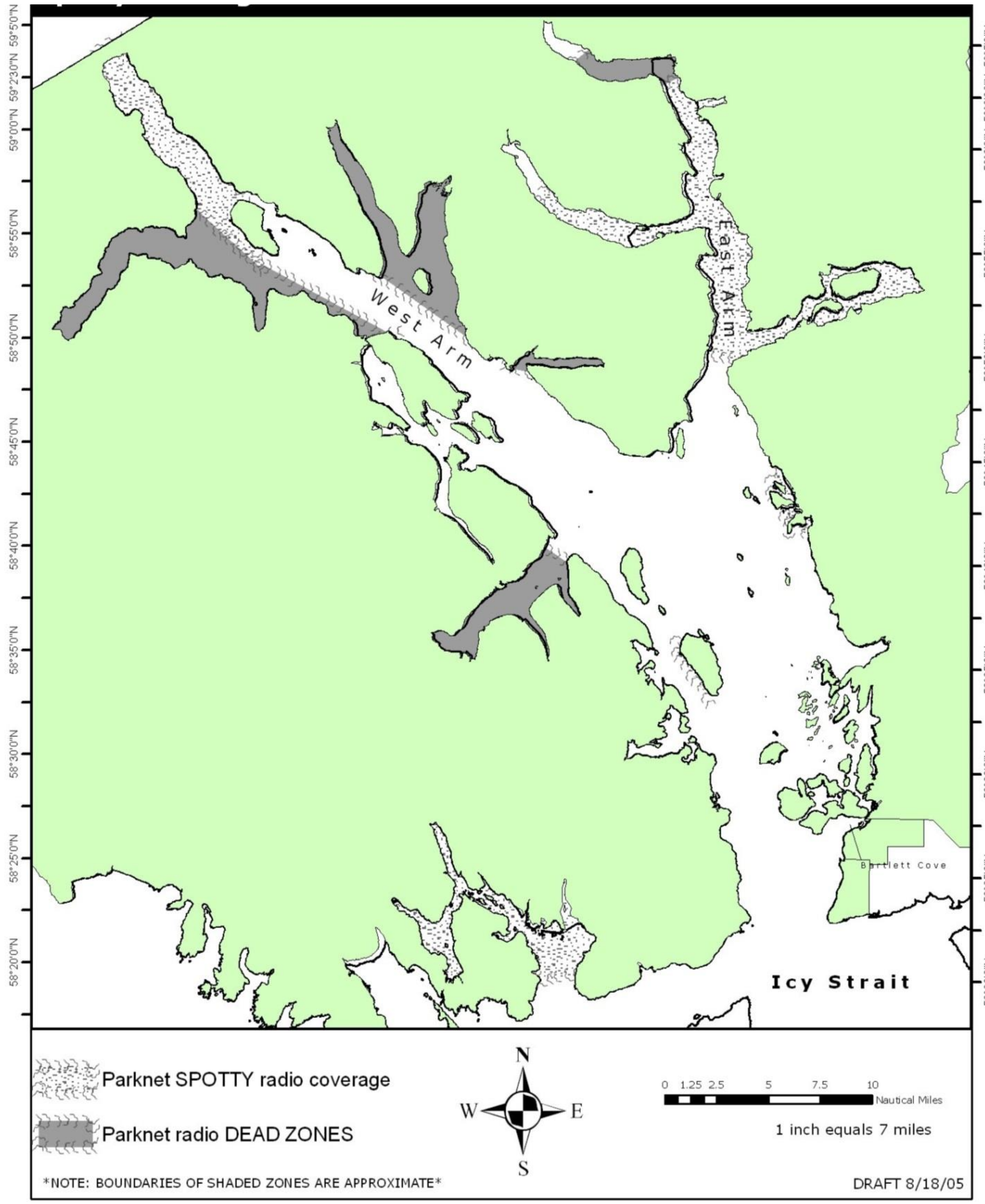


Figure 3. Radio coverage map (Glacier Bay proper).

Appendices

Appendices in their current versions can be found at:

https://sites.google.com/a/nps.gov/arcc-region/home/documents

Appendix A. Backcountry Itinerary: see “ARCC Backcountry Itinerary”

Appendix B. Float Plan: see “ARCC Float Plan”

Appendix C. Flight Plan: see “ARCC Flight Plan”

E.4 GLBA Boating Policy (2009)

United States Department of the Interior

NATIONAL PARK SERVICE

Glacier Bay National Park and Preserve

P.O. Box 140

Gustavus, AK 99826-0140

Tel: 907-697-2230

Fax: 907-697-2654

Glacier Bay National Park & Preserve

Boating Policy

For Park-Operated Motorized Vessels

Approved:

____ _______________

Susan L. Boudreau, Superintendent Date

POINT OF CONTACT: **Gus Martinez, GLBA Marine Safety Officer**

ALTERNATE POINT OF CONTACT: **Jake Ohlson, GLBA Park Safety Officer**

LAST UPDATED: **10/4/2012**

LOCATION OF POLICY:

HARD COPY: **Park Safety Office / Chief Ranger's Office**

DIGITAL COPY: **Q:\Administration A\Committees A24\Marine Operations Safety**

TABLE OF CONTENTS

1 INTRODUCTION

The Glacier Bay National Park and Preserve (GLBA) Boating Policy serves to ensure all motorized boating missions aboard National Park Service (NPS) or other vessels carrying NPS employees (and/or their representatives) are conducted in a safe and efficient manner. Equipment, training, and operations are to be maintained in accordance with agency and industry standards. With consideration to the unique, complex environment and changing sea conditions experienced in Glacier Bay National Park and Preserve, safety is to be the paramount priority in all park boating operations. The following policy shall be enforced to meet or exceed the requirements established in Department of the Interior (DOI) Departmental Manual 485 Chapter 22 and NPS Reference Manual 50B Chapter 9 **(see Appendix A)**. This policy is not designed to provide absolute direction for any given situation; rather, it establishes basic parameters for the operation of motorized vessels within Glacier Bay National Park and Preserve. Common sense, local knowledge, weather and sea conditions, operational leadership concepts, and experience of the individual operator and crew will be taken into account by all employees and managers when deciding to embark upon a specific vessel-based mission. Requests to conduct operations that are contrary to policy must be submitted through the employees' supervisor in writing, justifying the deviation and providing mitigation strategies to ensure the safety of all personnel. The park superintendent has the authority to approve, modify, curtail, or prohibit any operation. ***Any deviation from policy must be approved by the superintendent.***

Passengers aboard NPS vessels shall be limited to government employees, VIPs, volunteers, and/or passengers authorized by the superintendent. An operator may use his/her judgment to exclude any passenger if the operator feels that vessel or mission safety may be compromised by that individual or group of individuals.

2 DUTIES AND RESPONSIBILITIES

A. *Supervisors and Project Leaders will:*

- Ensure that watercraft operations are conducted in a safe manner and in compliance with established GLBA and DOI policies.
- Ensure that watercraft and equipment are maintained in compliance with existing policies and procedures.
- Ensure that all employees, volunteers, and others who operate or work in watercraft are trained and experienced in watercraft operations appropriate to the:
    1. Type and size of watercraft used
    2. Geographic and environmental conditions of the operation(s)
    3. Operational task being performed
- Ensure that all required safety and survival equipment is available.

B. The Boat Operator will:

- Complete the Department of Interior Motorboat Operator Certification Course (DOIMOCC) and maintain certification.
- Be responsible for the safety of personnel on board regardless of position or grade.
- Operate the watercraft safely, in compliance with existing policies, guidelines, and training.
- Determine what safety and survival equipment is needed and ensure that the required safety equipment is on board and is in serviceable condition.
- Brief crew and passengers on emergency procedures (e.g. issuing a Mayday, fire, capsizing) and emergency equipment location prior to mission embarkation.

C. The Boat Crew and Passengers will:

- Take responsibility for their own safety. Be prepared!
- Assist with other operations as required or directed by the operator.
- Adhere to boating and operational policies.

D. The Marine Operations Committee will:

- Consist of at least one experienced person from each park division that has boat operations.
- Meet at least quarterly to review boating safety issues, review and update policy, plan future training sessions, and determine marine operations needs.
- Advise the superintendent and management team on boating issues.
- Review reported boating accidents and incidents.

3 TRAINING AND CERTIFICATION

Following training and verification of proficiency, individually tailored vessel operation certification letters will be issued to employees detailing:

- The type of vessel(s) they are authorized to operate
- The geographic bounds within which they are authorized to operate
- The types of missions for which the operator and vessel are authorized
- The weather, sea, and visibility conditions under which they are allowed to operate

A. Basic Certification

The content and requirements for the Department of Interior Motorboat Operator Certification Course (DOIMOCC) are described in DOI 485 DM 22. In addition to these requirements, DOIMOCC at GLBA is to include coursework on park-specific boating subjects, including vessel loading and stability, local knowledge, vessel maintenance, troubleshooting, and other pertinent subjects.

Upon successful completion of the basic DOIMOCC course, the student will be certified to operate skiffs alone, but only under the following conditions:

- Daylight hours
- Unrestricted visibility (e.g. no fog).
- Beaufort Scale force three or less **(see Appendix B)**
- Only within the geographic bounds of Bartlett Cove (BARCO).

B. Advanced Certification

If the certified DOIMOCC operator subsequently wishes to travel beyond BARCO or advance their certification, they must (in this order):

- **Provide documentation of a minimum of 10 hours of operation** of that class vessel with an operator certified to the level of competency sought by the less-experienced operator. This documentation will show areas of operation, sea conditions experienced, weather, and nighttime operations if applicable.
- The operator shall **obtain a written recommendation** specifying the next level of certification. This recommendation shall come from a more-experienced operator who has consistently observed the individual safely operating that class vessel under the range of conditions commensurate with the next level of certification. This recommendation will include areas in which the vessel may be operated, sea conditions, and visibility restrictions.
- The **supervisor of the requesting operator must give concurrence**.
- **Pass a check-ride and tabletop exercise** with the boating officer and either a USCG licensed operator or a DOIMOCC instructor. The evaluation shall be based on the operator's skill and knowledge relating to the following:
    1. Type of vessel
    2. Geography
    3. Mission
    4. Conditions (environment of operations)
    5. Local knowledge
- The operator's **division chief will be responsible to approve the certification** and any endorsements or limitations.

C. DOIMOCC Recertification

At GLBA it is required that all vessel operators attend a DOIMOCC refresher course no more than two years after the original or previous refresher training. The eight-hour refresher course will consist of a four-hour classroom lesson and a four-hour hands-on exercise that will include immersion suit training.

Operators may request that a designated instructor review their proficiency and give written approval to operate a vessel if they have not attended the refresher class within the past two years. Regardless of written approval and level of proficiency, each operator must attend a refresher course every five years (in accordance with 485 DM 22).

D. U.S. Coast Guard Licensing

Operators who have current and documented USCG licensing may operate vessels that are covered by their license without attending DOIMOCC **only with** written approval from the park superintendent. The minimum requirement is an orientation to park boating and NPS policies by a designated instructor.

4 REQUIRED EQUIPMENT

A. Navigational Equipment

All vessels shall have on board:

- The most current paper navigational charts covering the area in which they are operating
- Correct tide tables for the area

B. Vessel Safety Equipment

Each vessel shall carry all safety equipment required by the USCG and Alaska State regulations **(see Appendix C)**. All GLBA government vessels shall be equipped with a park radio and a backup VHF radio (a spare park radio or standard VHF radio) and immersion suits for each passenger on board. GLBA employees on official business in commercial, private, or other agencies' vessels shall carry at least one park radio and spare batteries and an immersion suit of proper size. This excludes commercial vessels required by USCG regulations to provide life saving equipment such as life rafts (e.g. cruise ships and tour boats).

In addition to USCG requirements and immersion suits, all vessels shall have the following equipment:

- A secondary means of propulsion (oars, kicker motor, second engine)
- Bailing bucket
- One anchor
- Spare kill switch for outboards
- Fuel absorbent pads
- A survival kit or "ditch bag" **(see Appendix D)**
- Basic tool kit **(see Appendix E)**
- Spare propeller
- Spare parts and supplies **(see Appendix F)**

C. *Personal Protective Equipment/Personal Flotation Devices*

DOI 485 DM 22 requires that all personal flotation devices (PFDs) be international orange in color and equipped with type I retro-reflective tape in accordance with 46 CFR 25.25-15 **(see Appendix A)**.

In addition, at GLBA, when a skiff or vessel 18 feet or less in length is taken out of BARCO or out of sight of a support vessel, all occupants shall wear full (coverall style) exposure suits (e.g., Mustang suits) or dry suits with a PFD. Written permission from the superintendent must be obtained prior to departure when conditions warrant deviation from this requirement.

6 COMMUNICATIONS

At least one person on each motorized vessel shall monitor marine VHF channel 16 and the appropriate park frequency for the area at all times while underway. The radio monitor, whether the vessel operator or a passenger, must be able to hear and respond to radio traffic.

A. *Float Plans and Vessel Tracking*

Prior to departing Bartlett Cove, all vessels must call BARCO or visit the Visitor Information Station (VIS) to file a float plan that includes the name of the vessel, number and identity of people on board, and their estimated time of return (ETR) to Bartlett Cove or other destination **(see Appendix G)**. A float plan should also be filed for each day upon departure from overnight locations or anchorages. All vessels must close or modify their float plan prior to the ETR. If a deviation occurs from the float plan, a call must be made to inform BARCO of these changes. If the vessel is going out overnight, two check-in calls per day are required: one in the morning and one in the evening. Supervisors of vessel operators will ensure that a plan is in place for who to contact in case the vessel is overdue. Operators are encouraged to establish a more frequent check-in schedule with BARCO as conditions warrant.

Procedure if going out of communication range: Vessels transiting into known park radio dead zones **(see Appendix H)** should notify the VIS or other monitoring NPS staff of when they anticipate being out of the dead zone and back in radio contact. Vessels and operators that regularly frequent radio dead zones or are planning to occupy these areas for more than a day should arrange alternative communication (e.g., satellite phone). Vessels that are in radio dead zones longer than they anticipated are encouraged to arrange for other vessels in the area to relay information to BARCO or other park vessels.

B. *Electronic Vessel Tracking* ***(RESERVED)***

7 OPERATING PROCEDURES

A. Inspections

Pretrip inspection: The vessel operator is required to ensure all vessel systems are operating normally and that required safety and other necessary equipment is aboard and in serviceable condition prior to the start of each mission.

B. Load Limitations

Operators and employees will not exceed the personnel or weight limits of the vessel as determined by the manufacturer (as indicated on the vessel's capacity plate).

C. Weather Limitations

Skiffs are prohibited from embarking on a mission beyond BARCO under a standing National Weather Service small craft advisory unless a risk assessment model is used to evaluate risk given existing and forecasted weather conditions and mission objectives prior to departure. Missions can proceed only when risk is deemed acceptable under an approved risk model (e.g., GAR or SPE) (see Appendix J).

D. ***Job Hazard Analyses*** are to be completed for all vessel-based missions and referenced regularly by the operators who undertake these missions **(see Appendix I)**.

E. Prohibited Activities

- No operator or passenger shall consume alcohol within eight hours prior to vessel operation.
- There shall be no recreational fishing or any other personal recreational use from a government-owned vessel.
- No park motor vessel shall transit through the "cut" to the inner lagoon/administrative dock when any part of the big rock is showing.

8 ACCIDENT OR INCIDENT REPORTING

The following incidents must be reported immediately to the vessel operator and to the supervisor of the reporting employee:

1. Damage to a protected natural resource
2. Discharge of oil or gasoline that causes sheen
3. Fire and/or explosion
4. Any significant compromise in seaworthiness
5. Any significant damage to a vessel or safety equipment
6. Unintentional grounding
7. An injury requiring more than basic first aid
8. Collision with another vessel or object
9. Any man overboard

Supervisors are to report all accidents or incidents to the Marine Operations Committee within one month of the initial report for committee review.

9 VESSEL MAINTENANCE

Operator Responsibilities

Operators are responsible for fueling, cleaning, and scheduling the repair of vessels after each use.

10 GLOSSARY (RESERVED)

11 ATTACHMENTS (ITEMS IN RED FONT ARE IN DEVELOPMENT)

A) Referenced Policies/Regulations
   1) DOI 485 DM 22
   2) NPS RM 50B Chapter 9
   3) 46 CFR 25.25-15
B) Beaufort Scale for Wind Severity
C) State of Alaska Required Boating Equipment
D) Survival Kit or "Ditch Bag" Recommended Contents
E) Vessel Tool Kit Recommended Contents
F) Vessel Spare Part List Recommended Contents
G) Float Plan Sample
H) Glacier Bay Radio "Dead-Zone" Chart
I) Go/No Go Checklist
J) Risk Assessment Tool Worksheets
   1) GAR (Green/Amber/Red)
   2) SPE (Severity/Probability/Exposure)
K) Vessel Capability Chart
L) Vessel Start-Up Procedure
M) Check Ride Rating Form
N) Certification and Endorsement Sample
O) GLBA Marine Operations Committee Charter
P) Policy for Nonmotorized Vessels
Q) Job Hazard Analyses for Common GLBA Marine Operations
   1) Trailering
   2) Loading and Unloading Vessels
   3) Fueling
   4) Docking
   5) Anchoring
   6) Shore Landing
   7) Training
   8) Towing
   9) Field Maintenance and Repairs
   10) Maintenance Diagnostic Rides
   11) Moving Equipment from Boat to Shore Using Dinghy
   12) At-Sea Personnel Transfers
   13) General Law Enforcement Patrols
      I. Boarding Vessels
      II. Hauling Crab Gear

14) Oil Spill Response
15) Medical/EMS Transfers
16) Search and Rescue
17) Response to Vessel Grounding
18) Fuel Barge Operations
19) Research Operations
    I. Gear Deployment
    II. Dive Operations
    III. Towing Nets
    IV. Underwater Cable Maintenance
    V. Whale Surveys
20) Multiday Research Trips
21) Wildlife Rescue and Recovery

Appendix F. CTD Instruments Employed in Program

Certain deliverables make specific references to the individual CTD used for particular data. The following table identifies the individual physical device associated with each CTD number. Serial numbers of individual sensors are not reflected in this table, as they are subject to sudden change. Actual sensor identifiers for each particular CTD during a particular timeframe may be ascertained from its associated OC_A calibration file content.

Table F.1. CTD instruments employed by the monitoring program

CTD#	Model	Serial #	Started Service	Ended Service
1	Sea-Bird SBE19-03	193353-0436	4/1994	–
2	Sea-Bird SBE19-03	194652-0775	7/1993	1/2005
3	Sea-Bird SBE 19-03	194690-0819	6/1999	7/2000
4	Sea-Bird SBE 25	43	5/1994	7/2000
5	Sea-Bird SBE19-plus V2	19P55083-6353	2/2010	–

Operations at the time of this writing use CTD #5 as the primary field instrument. In the event it becomes unavailable, CTD #1 serves as backup. CTD #1 has less capacity and functionality than CTD #5. The SOPs define procedures that always work with CTD #1. These also work, of course, with the enhanced CTD #5. Altering field processes to take advantage of CTD #5's additional capacity is bad practice, because such processes will fail in the event the backup is deployed.

Appendix G. Data File Standard Header

The header strings, illustrated in Figure G.1, are required to be defined to the SeaTerm program on any computer used to download CTD data into HEX files. The strings must be one-to-one matches of the characters in the illustration. In particular, there must be no trailing spaces after any colon. Automated mandatory validation of HEX and CNV files will always fail unless this exact header is defined.

The header may be entered and edited using the "configuration" menu item with any version of the SeaTerm application. Originally this header was maintained on Windows computers in the file C:\WINDOWS\SeaTerm.ini. More recently, it may appear in several locations depending on the logged-in user and instrument configuration. A typical configuration file now might have a name like C:\Users\<*userid*>\\AppData\Local\Sea-Bird\IniFiles\SeatermV2.ini. When using a rosette sampler and the SeatermAF application, a typical name would be C:\Users\<*userid*>\Application Data\Sea-Bird\SeatermAF\SBE_55_ECO_with_SBE_19plusV2_6.psa.

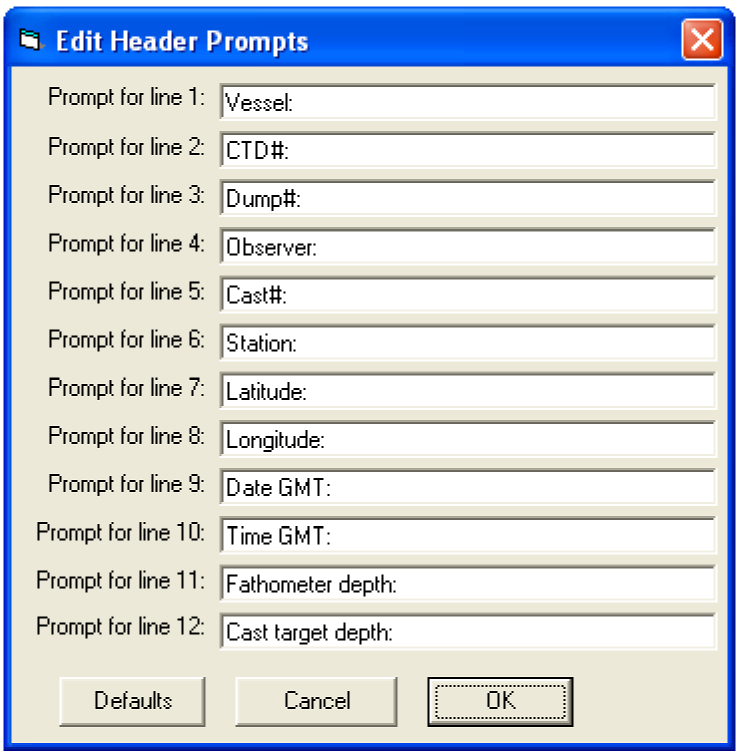


Figure G.1. Required header prompts to be used with SeaTerm software.

Appendix H. Typical Computer Directory Structures

Operating this program requires using a field laptop, a networked park computer, and the SEAN auxiliary repository. The data are normally stored in standard structures. The laptop is typically used to copy collected data from the CTD and then erase the CTD's memory to make room for more. The network file server is used to store transferred data from the field laptop. That server is also used in performing such data manipulation as quality control hex plotting. The park's server provides both data backup and fast access to data by the local Project Leader. The SEAN auxiliary repository is located in Juneau where it provides content to both internal and public web dissemination services.

1 Laptop Used to Capture Shipboard Data from CTD

Responsible person: Project Leader.

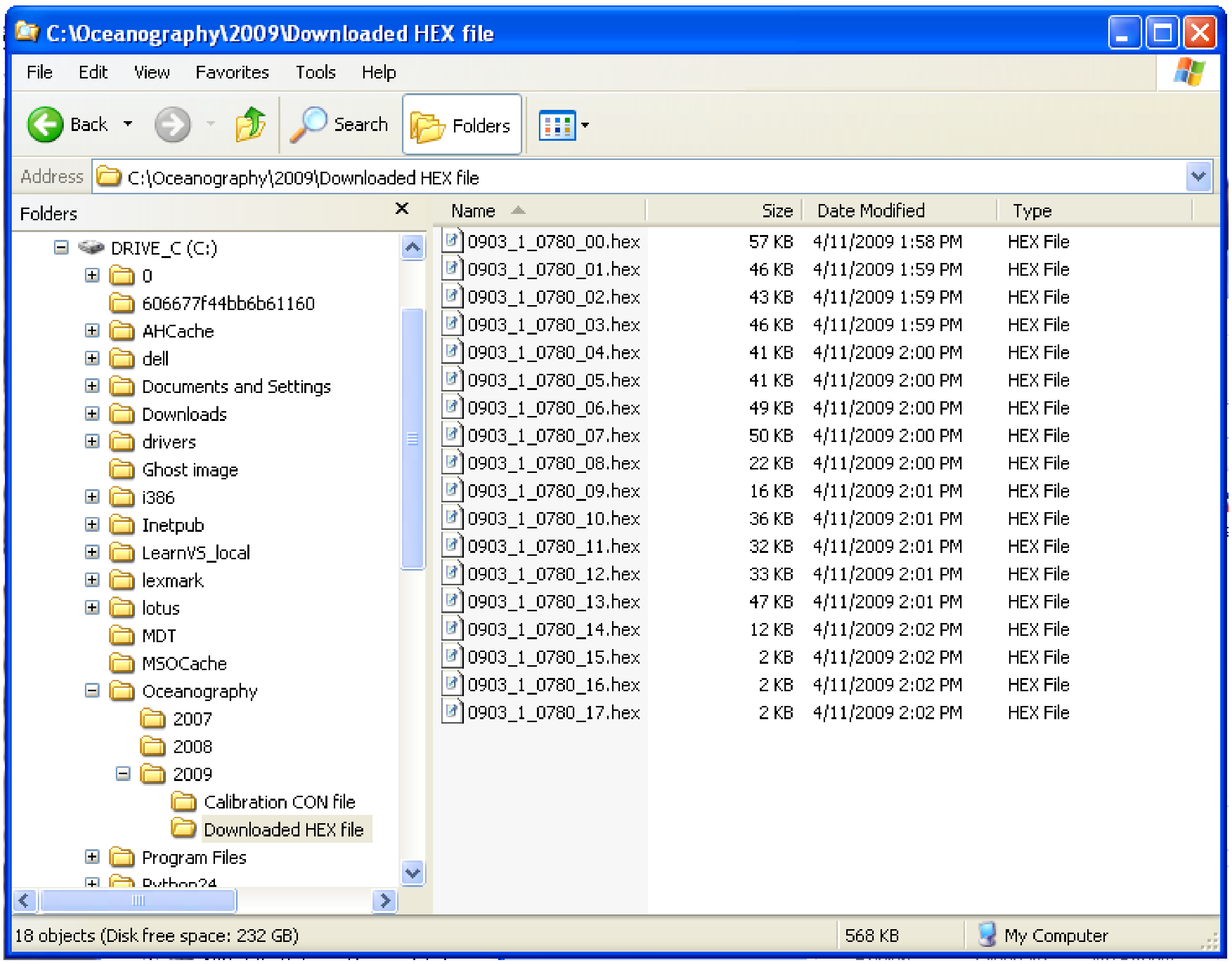


Figure H.1. Standard directory structure for field laptops used in data capture.

2 GLBA Network File Server Used For Building Deliverables

Responsible person: Project Leader.

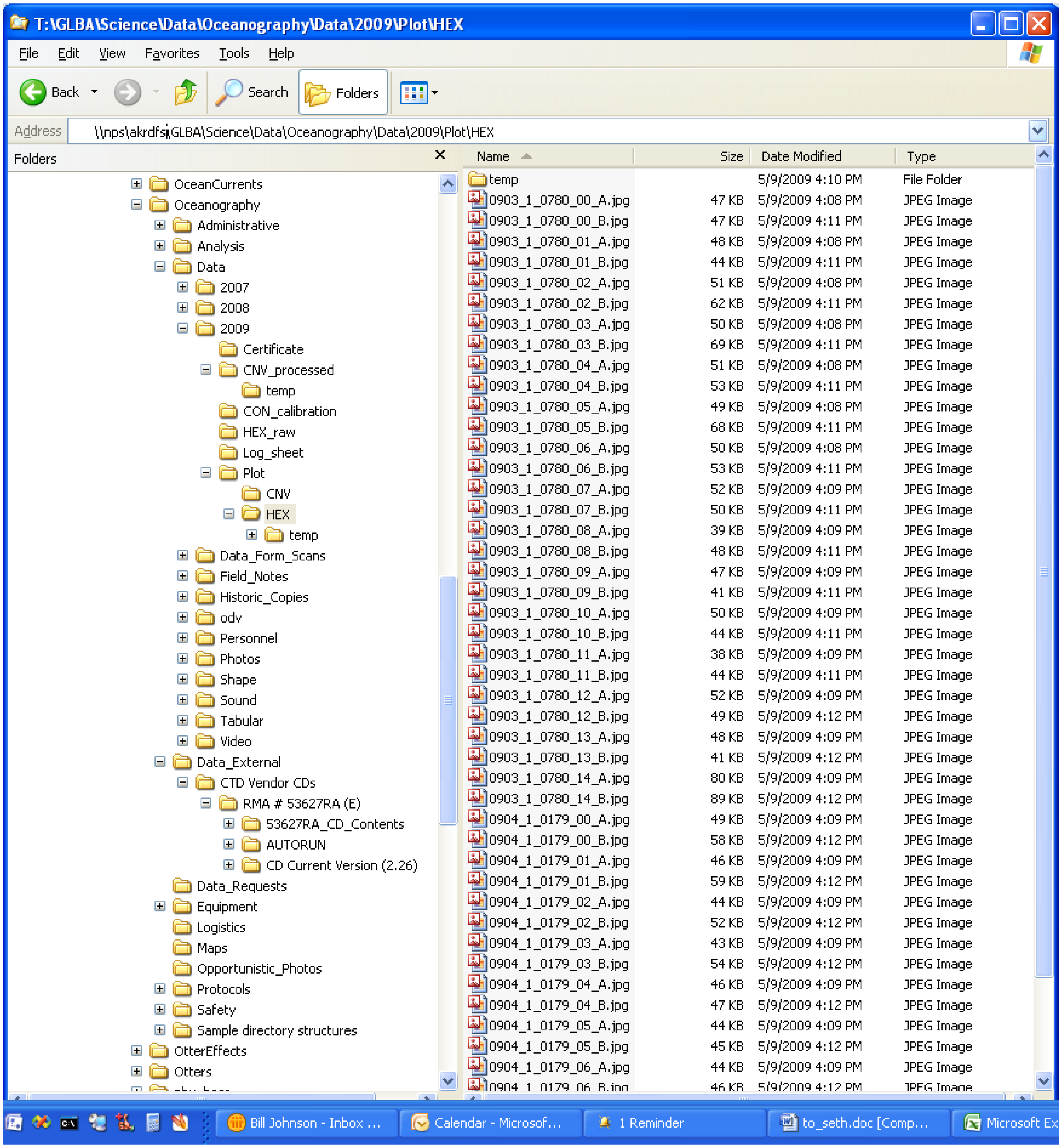


Figure H.2. Standard directory structure for park network file server.

3 SEAN Auxiliary Repository

Responsible person: Data Manager.

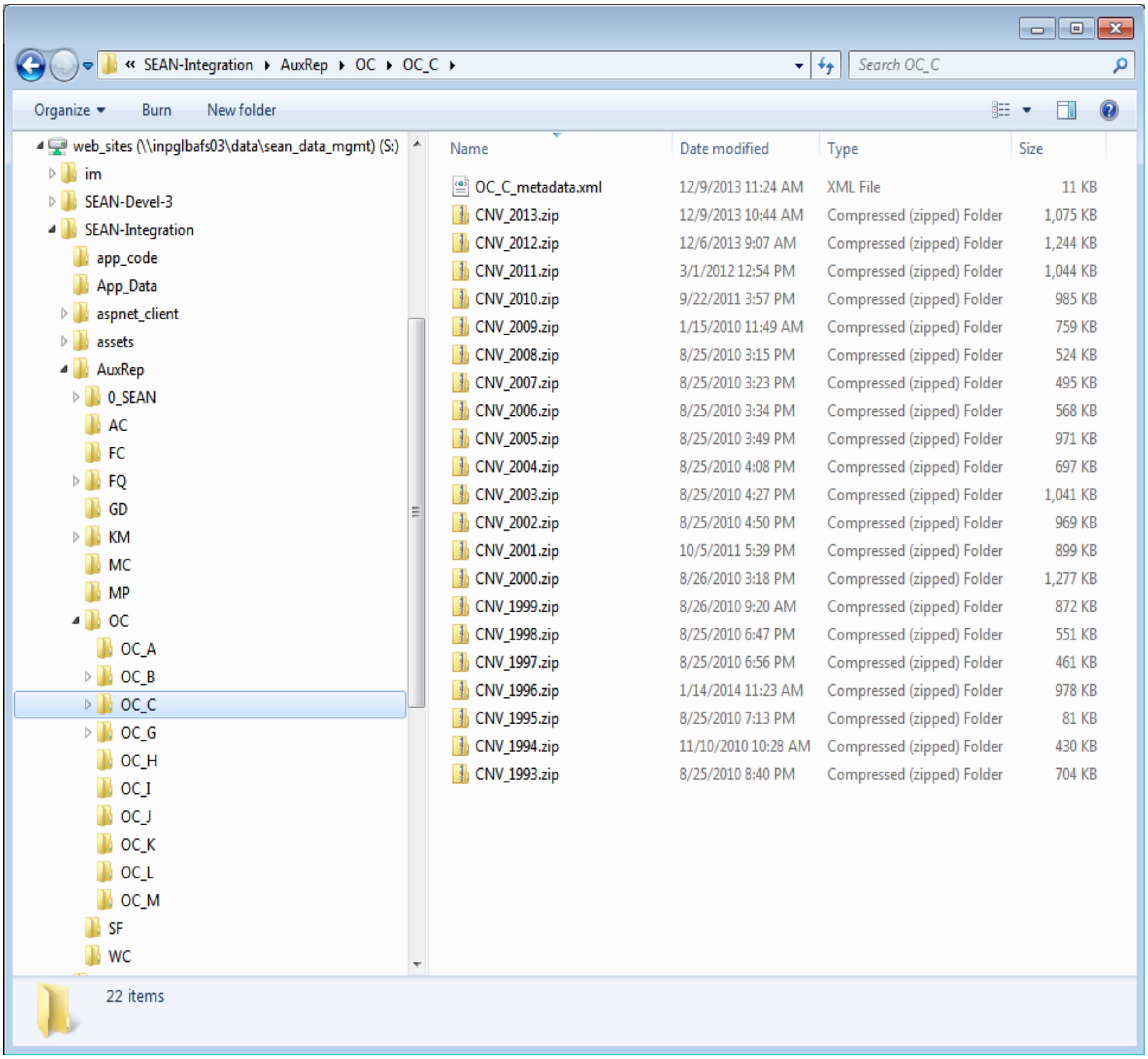


Figure H.3. Standard directory structure for oceanography section of SEAN auxiliary repository.

Appendix I. Processing Software Detailed Configuration

We employ the SBEDataProcessing package for 32-bit Windows, a product of Sea-Bird Electronics, to create the year's final OC_C dataset as well as the quality assurance "hex plots" and "cnv plots". The version used as of this writing is 7.22.

We configured the software to automatically do the numerous required processes when invoked using a DOS batch file. The operator provides the year of interest and name of the appropriate CON file and then parameters for every cast of the cruise year are plotted. Depending on the script executed, a full set of OC_C cast data files may also be produced simultaneously. Because processing tasks need to be defined separately for each configuration of instruments on the CTD, a different batch file is required for each unique combination of sensors that have been employed for the program. Currently there are three configurations: CTD #1, CTD #5 up to and including 2013, and CTD #5 from 2014 on. For each configuration there are two batch files: one to generate hex plots and one to generate OC_C CNV files along with CNVs plots.

The operational files currently used to perform these tasks follow. Copies of the source files are stored in \\files.glba.nps.gov\Science\Data\Oceanography\Data_External\Laptop config files. They require that input and output files conform to the prescribed directory structure shown in Appendix H. These files are typically stored in the ...\Program Files (x86)\Sea-Bird\ directory structure, but will function if placed in their own folder. Due to SBE software design, the user must have write permission on the folder holding these files.

Contents

I.1 CTD #1 Hex Plots

Listed in order encountered.

1. #1_Hex_Plot.bat invokes the processing.

```
@echo off
```

```
rem This file is #1_Hex_Plot.bat

type #1_hex_plot.doc

rem Get year and cal file name----------------------------------------
set /p sb-year=Enter 4-digit year:
set /p sb-cal=Enter calibration CON file name:

rem set environment ---------------------------------------------------
set path=%path%;C:\\Program Files\\sea-bird\\sbedataprocessing-win32
set sb-base-dir=\\files.glba.nps.gov\Science\Data\Oceanography\Data\%sb-year%\

rem invoke SBEBatch to make CNV from HEX and then plot the CNVs --------
sbebatch #1_hex_plot.txt %sb-base-dir% %sb-cal%
```

2. #1_hex_plot.doc notifies the user of what is about to happen.

```
----------------------------------------------------------
Generate QA plots of oceanographic hex data files.
This only works properly when using CTD #1: Sea-Bird19 s/n 0436.

Your workstation must be connected to the NPS network.
Plot images are placed in
\\files.glba.nps.gov\Science\Data\Oceanography\\Data\YYYY\Plot\Hex\
----------------------------------------------------------
```

3. #1_hex_plot.txt tells the sbebatch.exe application what processes to execute in what order.

```
datcnv /i%1hex_raw\*.hex /o%1plot\hex\temp /c%1con_calibration\%2
/p#1_HEX_to_CNV_for_Plotting.psa /s
seaplot /i%1plot\hex\temp\*.cnv /o%1plot\hex /p#1_HEX_Plot_A.psa /s
seaplot /i%1plot\hex\temp\*.cnv /o%1plot\hex /p#1_HEX_Plot_B.psa /s
```

4. #1_HEX_to_CNV_for_Plotting.psa informs the datcnv.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Data_Conversion >
  <Version value="7.18c" />
  <ServerName value="Data Conversion" />
  <InstrumentPath
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\con_calibration\1_0903.co
n" />
  <InstrumentMatch value="0" />
  <InputDir value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010hex_raw" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\plot\hex\temp" />
  <NameAppend value="" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <ProcessScansToEnd value="1" />
  <ScansToSkip value="180" />
  <ScansToProcess value="1" />
  <MergeHeaderFile value="0" />
  <OutputFormat value="0" high="1" low="0" initialValue="0" />
  <FromCast value="1" high="1" low="0" initialValue="0" />
  <CreateFile value="0" high="2" low="0" initialValue="0" />
  <ScanRangeSource value="3" high="3" low="0" initialValue="3" />
  <ScanRangeOffset value="0.000000" />
  <ScanRangeDuration value="2.000000" />
  <CalcArray Size="10" >
    <CalcArrayItem index="0" CalcID="15" >
      <Calc UnitID="54" Ordinal="0" >
        <FullName value="Density [sigma-t, Kg/m^3 ]" />
      </Calc>
    </CalcArrayItem>
```

```
      <CalcArrayItem index="1" CalcID="17" >
        <Calc UnitID="31" Ordinal="0" >
          <FullName value="Depth [salt water, m]" />
          <Latitude value="58.500000" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="2" CalcID="35" >
        <Calc UnitID="38" Ordinal="0" >
          <FullName value="Fluorescence, Wetlab Wetstar [mg/m^3]" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="3" CalcID="45" >
        <Calc UnitID="45" Ordinal="0" >
          <FullName value="OBS, Backscatterance (D &amp; A) [NTU]" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="4" CalcID="59" >
        <Calc UnitID="-1" Ordinal="0" >
          <FullName value="PAR/Irradiance, Biospherical/Licor" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="5" CalcID="70" >
        <Calc UnitID="49" Ordinal="0" >
          <FullName value="Salinity [PSU]" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="6" CalcID="81" >
        <Calc UnitID="6" Ordinal="0" >
          <FullName value="Temperature [ITS-90, deg C]" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="7" CalcID="67" >
        <Calc UnitID="3" Ordinal="0" >
          <FullName value="Pressure, Strain Gauge [db]" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="8" CalcID="55" >
        <Calc UnitID="40" Ordinal="0" >
          <FullName value="Oxygen, SBE 43 [ml/l]" />
          <WindowSize value="2.000000" />
          <ApplyHysteresisCorrection value="1" />
          <ApplyTauCorrection value="1" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="9" CalcID="12" >
        <Calc UnitID="58" Ordinal="0" >
          <FullName value="Conductivity [S/m]" />
        </Calc>
      </CalcArrayItem>
    </CalcArray>
    <MiscellaneousDataForCalculations >
      <Latitude value="58.500000" />
      <DescentRateAndAcceleration >
        <WindowSize value="2.000000" />
      </DescentRateAndAcceleration>
      <Oxygen >
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Oxygen>
      <AverageSoundVelocity >
        <MinimumPressure value="20.000000" />
        <MinimumSalinity value="20.000000" />
        <PressureWindowSize value="20.000000" />
        <TimeWindowSize value="60.000000" />
      </AverageSoundVelocity>
      <PlumeAnomaly >
        <ThetaB value="0.000000" />
        <SalinityB value="0.000000" />
        <ThetaZSalinityZRatio value="0.000000" />
        <ReferencePressure value="0.000000" />
```

```
    </PlumeAnomaly>
    <PotentialTempAnomaly >
      <A0 value="0.000000" />
      <A1 value="0.000000" />
      <A1Multiplier value="0" />
    </PotentialTempAnomaly>
  </MiscellaneousDataForCalculations>
</Data_Conversion>
```

5. #1_HEX_Plot_A.psa informs seaplot.exe for generating the “A” series of profile plots.

```
[content omitted due to length]
```

6. #1_HEX_Plot_B.psa informs seaplot.exe for generating the “B” series of profile plots.

```
[content omitted due to length]
```

I.2 CTD#1 CNV Files/Plots Through Cruise Year 2013

Listed in order encountered.

1. #1_CNV_Create.bat invokes the processing.

```
@echo off
rem This file is #1_CNV_Create.bat

type #1_cnv_create.doc

rem Get year and cal file name-----------------------------------------
set /p sb-year=Enter four-digit year:
set /p sb-cal=Enter calibration CON file name:

rem set environment ----------------------------------------------------
set path=%path%;C:\\Program Files\\sea-bird\\sbedataprocessing-win32
set sb-base-dir=\\files.glba.nps.gov\Science\Data\Oceanography\Data\%sb-year%\

rem invoke SBEBatch to make CNV from HEX and then plot the CNVs --------
sbebatch #1_CNV_Create.txt %sb-base-dir% %sb-cal%
```

2. #1_CNV_create.doc notifies the user of what is about to happen.

```
---------------------------------------------------------------------
Generate OC_C CNV files from hex data files.
Your workstation must be connected to the NPS network.
Plot images of the CNV files are placed in
\\files.glba.nps.gov\Science\Data\Oceanography\Data\yyyy\Plot\CNV\.
Data files are in
\\files.glba.nps.gov\Science\Data\Oceanography\Data\yyyy\CNV_processed\.

*** This automation works only for CTD#1, s/n 0436 ***
--------------------------------------------------------------------- -------------------
--------
```

3. #1_CNV_Create.txt tells the sbebatch.exe application what processes to execute in what order.

```
datcnv /i%1hex_raw\*.hex /o%1CNV_Processed\temp /c%1CON_calibration\%2
/p#1_CNV_Convert.psa /s /a_C
Filter /i%1CNV_Processed\temp\*_C.cnv /o%1CNV_Processed\temp /p#1_CNV_Filter.psa /s /a_F
Alignctd /i%1CNV_Processed\temp\*_F.cnv /o%1CNV_Processed\temp /p#1_CNV_AlignCTD.psa /s
/a_A
CellTM /i%1CNV_Processed\temp\*_A.cnv /o%1CNV_Processed\temp /p#1_CNV_CellTM.psa /s /a_M
```

```
Loopedit /i%1CNV_Processed\temp\*_M.cnv /o%1CNV_Processed\temp /p#1_CNV_LoopEdit.psa /s
/a_L
Derive /i%1CNV_Processed\temp\*_L.cnv /o%1CNV_Processed\temp /c%1CON_calibration\%2
/p#1_CNV_Derive.psa /s /a_D
Binavg /i%1CNV_Processed\temp\*_D.cnv /o%1CNV_Processed /p#1_CNV_Binavg.psa /s /a_B
Seaplot /i%1CNV_Processed\*.cnv /o%1plot\cnv /p#1_CNV_Plot_A.psa /s
Seaplot /i%1CNV_Processed\*.cnv /o%1plot\cnv /p#1_CNV_Plot_B.psa /s seaplot
```

4. #1_CNV_convert.psa informs the datcnv.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Data_Conversion >
  <Version value="7.18c" />
  <ServerName value="Data Conversion" />
  <InstrumentPath
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CON_calibration\1_0436.co
n" />
  <InstrumentMatch value="0" />
  <InputDir value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\HEX_raw" />
  <InputFileArray size="0" GrowBy="-1" />
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <NameAppend value="_C" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <ProcessScansToEnd value="1" />
  <ScansToSkip value="180" />
  <ScansToProcess value="1" />
  <MergeHeaderFile value="0" />
  <OutputFormat value="0" high="1" low="0" initialValue="0" />
  <FromCast value="1" high="1" low="0" initialValue="0" />
  <CreateFile value="0" high="2" low="0" initialValue="0" />
  <ScanRangeSource value="3" high="3" low="0" initialValue="3" />
  <ScanRangeOffset value="0.000000" />
  <ScanRangeDuration value="2.000000" />
  <CalcArray Size="7" >
    <CalcArrayItem index="0" CalcID="35" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, Wetlab Wetstar [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="45" >
      <Calc UnitID="45" Ordinal="0" >
        <FullName value="OBS, Backscatterance (D &amp; A) [NTU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="81" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="67" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="6" CalcID="57" >
      <Calc UnitID="63" Ordinal="0" >
        <FullName value="Oxygen Voltage, SBE 43" />
        <ApplyHysteresisCorrection value="1" />
```

```
        </Calc>
      </CalcArrayItem>
    </CalcArray>
    <MiscellaneousDataForCalculations >
      <Latitude value="58.500000" />
      <DescentRateAndAcceleration >
        <WindowSize value="2.000000" />
      </DescentRateAndAcceleration>
      <Oxygen >
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Oxygen>
      <AverageSoundVelocity >
        <MinimumPressure value="20.000000" />
        <MinimumSalinity value="20.000000" />
        <PressureWindowSize value="20.000000" />
        <TimeWindowSize value="60.000000" />
      </AverageSoundVelocity>
      <PlumeAnomaly >
        <ThetaB value="0.000000" />
        <SalinityB value="0.000000" />
        <ThetaZSalinityZRatio value="0.000000" />
        <ReferencePressure value="0.000000" />
      </PlumeAnomaly>
      <PotentialTempAnomaly >
        <A0 value="0.000000" />
        <A1 value="0.000000" />
        <A1Multiplier value="0" />
      </PotentialTempAnomaly>
    </MiscellaneousDataForCalculations>
  </Data_Conversion>
```

5. #1_CNV_filter.psa informs the filter.exe application.

```
<?xml version="1.0" encoding="UTF-8"?>
<Filter >
  <Version value="7.18c" />
  <ServerName value="Filter" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2103\CNV_Processed\temp" />
  <NameAppend value="_F" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <TimeConstFilterA value="0.500000" />
  <TimeConstFilterB value="2.000000" />
  <CalcArray Size="7" >
    <CalcArrayItem index="0" CalcID="35" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, Wetlab Wetstar [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="45" >
      <Calc UnitID="45" Ordinal="0" >
        <FullName value="OBS, Backscatterance (D &amp; A) [NTU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="81" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
```

```
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="67" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="6" CalcID="57" >
      <Calc UnitID="63" Ordinal="0" >
        <FullName value="Oxygen Voltage, SBE 43" />
        <ApplyHysteresisCorrection value="1" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <FilterTypeArray >
    <ArrayItem index="0" value="0" />
    <ArrayItem index="1" value="0" />
    <ArrayItem index="2" value="0" />
    <ArrayItem index="3" value="1" />
    <ArrayItem index="4" value="2" />
    <ArrayItem index="5" value="1" />
    <ArrayItem index="6" value="0" />
  </FilterTypeArray>
</Filter>
```

6. #1_CNV_alignCTD.psa informs the alignctd.exe application.

```
<?xml version="1.0" encoding="UTF-8"?>
<Align_CTD >
  <Version value="7.18c" />
  <ServerName value="Align CTD" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2103\CNV_Processed\temp" />
  <NameAppend value="_a" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <CalcArray Size="6" >
    <CalcArrayItem index="0" CalcID="35" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, Wetlab Wetstar [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="45" >
      <Calc UnitID="45" Ordinal="0" >
        <FullName value="OBS, Backscatterance (D &amp; A) [NTU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="81" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
```

```
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="57" >
      <Calc UnitID="63" Ordinal="0" >
        <FullName value="Oxygen Voltage, SBE 43" />
        <ApplyHysteresisCorrection value="1" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <ValArray size="6" >
    <ValArrayItem index="0" value="0.000000" variable_name="Fluorescence, Wetlab Wetstar"
/>
    <ValArrayItem index="1" value="0.000000" variable_name="OBS, Backscatterance (D &amp;
A)" />
    <ValArrayItem index="2" value="0.000000" variable_name="PAR/Irradiance,
Biospherical/Licor" />
    <ValArrayItem index="3" value="0.500000" variable_name="Temperature" />
    <ValArrayItem index="4" value="0.000000" variable_name="Conductivity" />
    <ValArrayItem index="5" value="5.000000" variable_name="Oxygen Voltage, SBE 43" />
  </ValArray>
</Align_CTD>
```


7. #1_CNV_cellTM.psa informs the celltm.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Cell_Thermal_Mass >
  <Version value="7.18c" />
  <ServerName value="Cell Thermal Mass" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data2010\CNV_Processed\temp" />
  <NameAppend value="_M" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <Primary >
    <Correct value="1" />
    <TempSensor value="0" />
    <TA_Amplitude value="0.040000" />
    <TA_TimeConstant value="8.000000" />
  </Primary>
  <Secondary >
    <Correct value="0" />
    <TempSensor value="1" />
    <TA_Amplitude value="0.030000" />
    <TA_TimeConstant value="7.000000" />
  </Secondary>
</Cell_Thermal_Mass>
```


8. #1_CNV_loopedit.psa informs the loopedit.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Loop_Edit >
  <Version value="7.18c" />
  <ServerName value="Loop Edit" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_Processed\temp" />
  <NameAppend value="_L" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <MinVelocityType value="0" high="1" low="0" initialValue="0" />
  <MinCTD_Velocity value="0.100000" />
  <TimeWindowSize value="300.000000" />
```

```
    <PercentMeanSpeed value="20.000000" />
    <ExcludeMarkedBad value="1" />
    <RemoveSurfaceSoak value="0" />
    <UseDeckPressure value="1" />
    <SurfaceSoakDepth value="10.000000" />
    <SurfaceSoakDepthMin value="5.000000" />
    <SurfaceSoakDepthMax value="20.000000" />
  </Loop_Edit>
```

9. #1_CNV_derive.psa informs the derive.exe application.

```
<?xml version="1.0" encoding="UTF-8"?>
<Derive >
  <Version value="7.18c" />
  <ServerName value="Derive" />
  <InstrumentPath
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CON_calibration\1_0436.co
n" />
  <InstrumentMatch value="0" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" />
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_Processed\temp" />
  <NameAppend value="_D" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <CalcArray Size="4" >
    <CalcArrayItem index="0" CalcID="15" >
      <Calc UnitID="54" Ordinal="0" >
        <FullName value="Density [sigma-t, Kg/m^3 ]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="70" >
      <Calc UnitID="49" Ordinal="0" >
        <FullName value="Salinity [PSU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="17" >
      <Calc UnitID="31" Ordinal="0" >
        <FullName value="Depth [salt water, m]" />
        <Latitude value="58.500000" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="55" >
      <Calc UnitID="40" Ordinal="0" >
        <FullName value="Oxygen, SBE 43 [ml/l]" />
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <MiscellaneousDataForCalculations >
    <Latitude value="58.500000" />
    <DescentRateAndAcceleration >
      <WindowSize value="2.000000" />
    </DescentRateAndAcceleration>
    <Oxygen >
      <WindowSize value="2.000000" />
      <ApplyHysteresisCorrection value="1" />
      <ApplyTauCorrection value="1" />
    </Oxygen>
    <AverageSoundVelocity >
      <MinimumPressure value="20.000000" />
      <MinimumSalinity value="20.000000" />
      <PressureWindowSize value="20.000000" />
      <TimeWindowSize value="60.000000" />
    </AverageSoundVelocity>
    <PlumeAnomaly >
```

```
        <ThetaB value="0.000000" />
        <SalinityB value="0.000000" />
        <ThetaZSalinityZRatio value="0.000000" />
        <ReferencePressure value="0.000000" />
      </PlumeAnomaly>
      <PotentialTempAnomaly >
        <A0 value="0.000000" />
        <A1 value="0.000000" />
        <A1Multiplier value="0" />
      </PotentialTempAnomaly>
    </MiscellaneousDataForCalculations>
  </Derive>
```

10. #1_CNV_binavg.psa informs the binavg.exe application.

```
<?xml version="1.0" encoding="UTF-8"?>
<Bin_Average >
  <Version value="7.18c" />
  <ServerName value="Bin Average" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed" />
  <NameAppend value="_B" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <BinType value="2" />
  <BinSize value="1.000000" />
  <IncludeNumberScans value="0" />
  <ExcludeMarkedBad value="1" />
  <ScansToSkip value="0" />
  <CastToProcess value="1" high="2" low="0" initialValue="0" />
  <IncludeSurfaceBin value="1" />
  <SurfaceBinMinVal value="0.200000" />
  <SurfaceBinMaxVal value="0.800000" />
  <SurfaceBinVal value="0.000000" />
</Bin_Average>
```

11. #1_CNV_Plot_A.psa informs seaplot.exe for generating the “A” series of profile plots.

```
[content omitted due to length]
```

12. #1_CNV_Plot_B.psa informs seaplot.exe for generating the “B” series of profile plots.

```
[content omitted due to length]
```

I.3 CTD #5 Hex Plots Through Cruise Year 2013

Listed in order encountered.

1. #5_Hex_Plot.bat invokes the processing.

```
@echo off

rem This file is #5_Hex_Plot.bat

type #5_hex_plot.doc

rem Get year and cal file name-----------------------------------------
set /p sb-year=Enter 4-digit year:
set /p sb-cal=Enter calibration CON file name:

rem set environment ----------------------------------------------------
```

```
set path=%path%;C:\\Program Files\\sea-bird\\sbedataprocessing-win32
set sb-base-dir=\\files.glba.nps.gov\Science\Data\Oceanography\Data\%sb-year%\

rem invoke SBEBatch to make CNV from HEX and then plot the CNVs --------
sbebatch #5_hex_plot.txt %sb-base-dir% %sb-cal%
```

2. #5_hex_plot.doc notifies the user of what is about to happen.

```
----------------------------------------------------------
Generate QA plots of oceanographic hex data files.
This only works properly when using CTD #5: Sea-Bird19PlusV2 s/n 6353.

Your workstation must be connected to the NPS network.
Plot images are placed in
\\files.glba.nps.gov\Science\Data\Oceanography\\Data\yyyy\Plot\Hex\
----------------------------------------------------------
```

3. #5_hex_plot.txt tells the sbebatch.exe application what processes to execute in what order.

```
datcnv /i%1hex_raw\*.hex /o%1plot\hex\temp /c%1con_calibration\%2
/p#5_HEX_to_CNV_for_Plotting.psa /s
seaplot /i%1plot\hex\temp\*.cnv /o%1plot\hex /p#5_HEX_Plot_A.psa /s
seaplot /i%1plot\hex\temp\*.cnv /o%1plot\hex /p#5_HEX_Plot_B.psa /s
```

4. #5_HEX_to_CNV_for_Plotting.psa informs the datcnv.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Data_Conversion >
  <Version value="7.18c" />
  <ServerName value="Data Conversion" />
  <InstrumentPath
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\con_calibration\5_6353.co
n" />
  <InstrumentMatch value="0" />
  <InputDir value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\hex_raw" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\plot\hex\temp" />
  <NameAppend value="" />
  <OutputFile value="" />
  <LastProcessed value="2" />
  <ProcessScansToEnd value="1" />
  <ScansToSkip value="180" />
  <ScansToProcess value="1" />
  <MergeHeaderFile value="0" />
  <OutputFormat value="0" high="1" low="0" initialValue="0" />
  <FromCast value="1" high="1" low="0" initialValue="0" />
  <CreateFile value="0" high="2" low="0" initialValue="0" />
  <ScanRangeSource value="3" high="3" low="0" initialValue="3" />
  <ScanRangeOffset value="0.000000" />
  <ScanRangeDuration value="2.000000" />
  <CalcArray Size="10" >
    <CalcArrayItem index="0" CalcID="15" >
      <Calc UnitID="54" Ordinal="0" >
        <FullName value="Density [sigma-t, Kg/m^3 ]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="17" >
      <Calc UnitID="31" Ordinal="0" >
        <FullName value="Depth [salt water, m]" />
        <Latitude value="58.500000" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="93" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]" />
```

```
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="87" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="Upoly 0, Turbidity" />
        <CalcName value="Turbidity" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="70" >
      <Calc UnitID="49" Ordinal="0" >
        <FullName value="Salinity [PSU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="6" CalcID="97" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="7" CalcID="95" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="8" CalcID="55" >
      <Calc UnitID="40" Ordinal="0" >
        <FullName value="Oxygen, SBE 43 [ml/l]" />
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="9" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <MiscellaneousDataForCalculations >
    <Latitude value="58.500000" />
    <DescentRateAndAcceleration >
      <WindowSize value="2.000000" />
    </DescentRateAndAcceleration>
    <Oxygen >
      <WindowSize value="2.000000" />
      <ApplyHysteresisCorrection value="1" />
      <ApplyTauCorrection value="1" />
    </Oxygen>
    <AverageSoundVelocity >
      <MinimumPressure value="20.000000" />
      <MinimumSalinity value="20.000000" />
      <PressureWindowSize value="20.000000" />
      <TimeWindowSize value="60.000000" />
    </AverageSoundVelocity>
    <PlumeAnomaly >
      <ThetaB value="0.000000" />
      <SalinityB value="0.000000" />
      <ThetaZSalinityZRatio value="0.000000" />
      <ReferencePressure value="0.000000" />
    </PlumeAnomaly>
    <PotentialTempAnomaly >
      <A0 value="0.000000" />
      <A1 value="0.000000" />
      <A1Multiplier value="0" />
    </PotentialTempAnomaly>
  </MiscellaneousDataForCalculations>
</Data_Conversion>
```

5. #5_HEX_Plot_A.psa informs seaplot.exe for generating the “A” series of profile plots.

```
[content omitted due to length]
```

6. #5_HEX_Plot_B.psa informs seaplot.exe for generating the “B” series of profile plots.

```
[content omitted due to length]
```

I.4 CTD#5 CNV Files/Plots Through Cruise Year 2013

Listed in order encountered.

1. #5_CNV_Create.bat invokes the processing.

```
@echo off
rem This file is CNV_Create.bat

type #5_cnv_create.doc

rem Get year and cal file name-----------------------------------------
set /p sb-year=Enter 4-digit year:
set /p sb-cal=Enter calibration CON file name:

rem set environment ----------------------------------------------------
set path=%path%;C:\\Program Files\\sea-bird\\sbedataprocessing-win32
set sb-base-dir=\\files.glba.nps.gov\Science\Data\Oceanography\Data\%sb-year%\

rem invoke SBEBatch to make CNV from HEX and then plot the CNVs --------
sbebatch #5_CNV_Create.txt %sb-base-dir% %sb-cal%
```

2. #5_CNV_create.doc notifies the user of what is about to happen.

```
---------------------------------------------------------------------
Generate OC_C CNV files from hex data files.
Your workstation must be connected to the NPS network.
Plot images of the CNV files are placed in
\\files.glba.nps.gov\Science\Data\Oceanography\Data\yyyy\Plot\CNV\.
Data files are in \\files.glba.nps.gov\Science\Data\Oceanography\Data\yyyy\CNV\.

This only works properly when using CTD #5: Sea-Bird19PlusV2 s/n 6353.
---------------------------------------------------------------------
```

3. #5_CNV_Create.txt tells the sbebatch.exe application what processes to execute in what order.

```
datcnv /i%1hex_raw\*.hex /o%1CNV_Processed\temp /c%1CON_calibration\%2
/p#5_CNV_Convert.psa /s /a_C
Filter /i%1CNV_Processed\temp\*_C.cnv /o%1CNV_Processed\temp /p#5_CNV_Filter.psa /s /a_F
Alignctd /i%1CNV_Processed\temp\*_F.cnv /o%1CNV_Processed\temp /p#5_CNV_AlignCTD.psa /s
/a_A
CellTM /i%1CNV_Processed\temp\*_A.cnv /o%1CNV_Processed\temp /p#5_CNV_CellTM.psa /s /a_M
Loopedit /i%1CNV_Processed\temp\*_M.cnv /o%1CNV_Processed\temp /p#5_CNV_LoopEdit.psa /s
/a_L
Derive /i%1CNV_Processed\temp\*_L.cnv /o%1CNV_Processed\temp /c%1CON_calibration\%2
/p#5_CNV_Derive.psa /s /a_D
Binavg /i%1CNV_Processed\temp\*_D.cnv /o%1CNV_Processed /p#5_CNV_Binavg.psa /s /a_B
Seaplot /i%1CNV_Processed\*.cnv /o%1plot\cnv /p#5_CNV_Plot_A.psa /s
Seaplot /i%1CNV_Processed\*.cnv /o%1plot\cnv /p#5_CNV_Plot_B.psa /s
```

4. #5_CNV_convert.psa informs the datcnv.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Data_Conversion >
  <Version value="7.18c" />
  <ServerName value="Data Conversion" />
  <InstrumentPath
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CON_calibration\5_6353.co
n" />
  <InstrumentMatch value="0" />
  <InputDir value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\HEX_raw" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <NameAppend value="_C" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <ProcessScansToEnd value="1" />
  <ScansToSkip value="180" />
  <ScansToProcess value="1" />
  <MergeHeaderFile value="0" />
  <OutputFormat value="0" high="1" low="0" initialValue="0" />
  <FromCast value="1" high="1" low="0" initialValue="0" />
  <CreateFile value="0" high="2" low="0" initialValue="0" />
  <ScanRangeSource value="3" high="3" low="0" initialValue="3" />
  <ScanRangeOffset value="0.000000" />
  <ScanRangeDuration value="2.000000" />
  <CalcArray Size="7" >
    <CalcArrayItem index="0" CalcID="93" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="87" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="Upoly 0, Turbidity" />
        <CalcName value="Turbidity" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="97" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="95" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="57" >
      <Calc UnitID="63" Ordinal="0" >
        <FullName value="Oxygen Voltage, SBE 43" />
        <ApplyHysteresisCorrection value="1" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="6" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <MiscellaneousDataForCalculations >
    <Latitude value="58.500000" />
    <DescentRateAndAcceleration >
      <WindowSize value="2.000000" />
```

```
      </DescentRateAndAcceleration>
      <Oxygen >
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Oxygen>
      <AverageSoundVelocity >
        <MinimumPressure value="20.000000" />
        <MinimumSalinity value="20.000000" />
        <PressureWindowSize value="20.000000" />
        <TimeWindowSize value="60.000000" />
      </AverageSoundVelocity>
      <PlumeAnomaly >
        <ThetaB value="0.000000" />
        <SalinityB value="0.000000" />
        <ThetaZSalinityZRatio value="0.000000" />
        <ReferencePressure value="0.000000" />
      </PlumeAnomaly>
      <PotentialTempAnomaly >
        <A0 value="0.000000" />
        <A1 value="0.000000" />
        <A1Multiplier value="0" />
      </PotentialTempAnomaly>
    </MiscellaneousDataForCalculations>
  </Data_Conversion>
```


5. #5_CNV_filter.psa informs the filter.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Filter >
  <Version value="7.18c" />
  <ServerName value="Filter" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <NameAppend value="_F" />
  <OutputFile value="" />
  <LastProcessed value="1" />
  <TimeConstFilterA value="0.500000" />
  <TimeConstFilterB value="1.000000" />
  <CalcArray Size="7" >
    <CalcArrayItem index="0" CalcID="93" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="87" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="Upoly 0, Upoly 0, Turbidity" />
        <CalcName value="Upoly 0, Turbidity" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="97" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="95" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
```

```
      <CalcArrayItem index="5" CalcID="57" >
        <Calc UnitID="63" Ordinal="0" >
          <FullName value="Oxygen Voltage, SBE 43" />
          <ApplyHysteresisCorrection value="1" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="6" CalcID="12" >
        <Calc UnitID="58" Ordinal="0" >
          <FullName value="Conductivity [S/m]" />
        </Calc>
      </CalcArrayItem>
    </CalcArray>
    <FilterTypeArray >
      <ArrayItem index="0" value="0" />
      <ArrayItem index="1" value="0" />
      <ArrayItem index="2" value="0" />
      <ArrayItem index="3" value="1" />
      <ArrayItem index="4" value="2" />
      <ArrayItem index="5" value="0" />
      <ArrayItem index="6" value="1" />
    </FilterTypeArray>
  </Filter>
```

6. #5_CNV_alignCTD.psa informs the alignctd.exe application.

```
<?xml version="1.0" encoding="UTF-8"?>
<Align_CTD >
  <Version value="7.18c" />
  <ServerName value="Align CTD" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_Processed\temp" />
  <NameAppend value="_a" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <CalcArray Size="7" >
    <CalcArrayItem index="0" CalcID="93" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="87" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="Upoly 0, Upoly 0, Turbidity" />
        <CalcName value="Upoly 0, Turbidity" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="97" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="95" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="57" >
      <Calc UnitID="63" Ordinal="0" >
        <FullName value="Oxygen Voltage, SBE 43" />
        <ApplyHysteresisCorrection value="1" />
      </Calc>
```

```
    </CalcArrayItem>
    <CalcArrayItem index="6" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <ValArray size="7" >
    <ValArrayItem index="0" value="0.000000" variable_name="Fluorescence, Wetlab ECO-
AFL/FL" />
    <ValArrayItem index="1" value="0.000000" variable_name="User Polynomial" />
    <ValArrayItem index="2" value="0.000000" variable_name="PAR/Irradiance,
Biospherical/Licor" />
    <ValArrayItem index="3" value="0.500000" variable_name="Temperature" />
    <ValArrayItem index="4" value="0.000000" variable_name="Pressure, Strain Gauge" />
    <ValArrayItem index="5" value="5.000000" variable_name="Oxygen Voltage, SBE 43" />
    <ValArrayItem index="6" value="0.000000" variable_name="Conductivity" />
  </ValArray>
</Align_CTD>
```


7. #5_CNV_cellTM.psa informs the celltm.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Cell_Thermal_Mass >
  <Version value="7.18c" />
  <ServerName value="Cell Thermal Mass" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <NameAppend value="_M" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <Primary >
    <Correct value="1" />
    <TempSensor value="0" />
    <TA_Amplitude value="0.040000" />
    <TA_TimeConstant value="8.000000" />
  </Primary>
  <Secondary >
    <Correct value="0" />
    <TempSensor value="1" />
    <TA_Amplitude value="0.030000" />
    <TA_TimeConstant value="7.000000" />
  </Secondary>
</Cell_Thermal_Mass>
```


8. #5_CNV_loopedit.psa informs the loopedit.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Loop_Edit >
  <Version value="7.18c" />
  <ServerName value="Loop Edit" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <NameAppend value="_L" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <MinVelocityType value="0" high="1" low="0" initialValue="0" />
  <MinCTD_Velocity value="0.100000" />
  <TimeWindowSize value="300.000000" />
  <PercentMeanSpeed value="20.000000" />
```

```
    <ExcludeMarkedBad value="1" />
    <RemoveSurfaceSoak value="0" />
    <UseDeckPressure value="1" />
    <SurfaceSoakDepth value="10.000000" />
    <SurfaceSoakDepthMin value="5.000000" />
    <SurfaceSoakDepthMax value="20.000000" />
  </Loop_Edit>
```


9. #5_CNV_derive.psa informs the derive.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Derive >
  <Version value="7.18c" />
  <ServerName value="Derive" />
  <InstrumentPath
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CON_calibration\5_6353.co
n" />
  <InstrumentMatch value="0" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <NameAppend value="_D" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <CalcArray Size="4" >
    <CalcArrayItem index="0" CalcID="15" >
      <Calc UnitID="54" Ordinal="0" >
        <FullName value="Density [sigma-t, Kg/m^3 ]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="70" >
      <Calc UnitID="49" Ordinal="0" >
        <FullName value="Salinity [PSU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="17" >
      <Calc UnitID="31" Ordinal="0" >
        <FullName value="Depth [salt water, m]" />
        <Latitude value="58.500000" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="55" >
      <Calc UnitID="40" Ordinal="0" >
        <FullName value="Oxygen, SBE 43 [ml/l]" />
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <MiscellaneousDataForCalculations >
    <Latitude value="58.500000" />
    <DescentRateAndAcceleration >
      <WindowSize value="2.000000" />
    </DescentRateAndAcceleration>
    <Oxygen >
      <WindowSize value="2.000000" />
      <ApplyHysteresisCorrection value="1" />
      <ApplyTauCorrection value="1" />
    </Oxygen>
    <AverageSoundVelocity >
      <MinimumPressure value="20.000000" />
      <MinimumSalinity value="20.000000" />
      <PressureWindowSize value="20.000000" />
      <TimeWindowSize value="60.000000" />
    </AverageSoundVelocity>
    <PlumeAnomaly >
```

```
      <ThetaB value="0.000000" />
      <SalinityB value="0.000000" />
      <ThetaZSalinityZRatio value="0.000000" />
      <ReferencePressure value="0.000000" />
    </PlumeAnomaly>
    <PotentialTempAnomaly >
      <A0 value="0.000000" />
      <A1 value="0.000000" />
      <A1Multiplier value="0" />
    </PotentialTempAnomaly>
  </MiscellaneousDataForCalculations>
</Derive>
```

10. #5_CNV_binavg.psa informs the binavg.exe application.

```
<?xml version="1.0" encoding="UTF-8"?>
<Bin_Average >
  <Version value="7.18c" />
  <ServerName value="Bin Average" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_processed" />
  <NameAppend value="_B" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <BinType value="2" />
  <BinSize value="1.000000" />
  <IncludeNumberScans value="0" />
  <ExcludeMarkedBad value="1" />
  <ScansToSkip value="0" />
  <CastToProcess value="1" high="2" low="0" initialValue="0" />
  <IncludeSurfaceBin value="1" />
  <SurfaceBinMinVal value="0.200000" />
  <SurfaceBinMaxVal value="0.800000" />
  <SurfaceBinVal value="0.000000" />
</Bin_Average>
```

11. #5_CNV_Plot_A.psa informs seaplot.exe for generating the “A” series of profile plots.

```
[content omitted due to length]
```

12. #5_CNV_Plot_B.psa informs seaplot.exe for generating the “B” series of profile plots.

```
[content omitted due to length]
```

I.5 CTD #5 Hex Plots Cruise Year 2014 and Later

Listed in order encountered.

1. #5_Hex_Plot_2014.bat invokes the processing.

```
@echo off

rem This file is #5_Hex_Plot_2014.bat

type #5_hex_plot_2014.doc

rem Get year and cal file name-----------------------------------------
set /p sb-year=Enter 4-digit year:
set /p sb-cal=Enter calibration CON file name:

rem set environment ----------------------------------------------------
```

```
set path=%path%;C:\\Program Files\\sea-bird\\sbedataprocessing-win32
set sb-base-dir=\\files.glba.nps.gov\Science\Data\Oceanography\Data\%sb-year%\

rem invoke SBEBatch to make CNV from HEX and then plot the CNVs --------
sbebatch #5_hex_plot_2014.txt %sb-base-dir% %sb-cal%
```

2. #5_hex_plot_2014.doc notifies the user of what is about to happen.

```
----------------------------------------------------------
Generate QA plots of oceanographic hex data files.
This only works properly when using CTD #5: Sea-Bird19PlusV2 s/n 6353 on data collected
in 2014 and later.

Your workstation must be connected to the NPS network.
Plot images are placed in
\\files.glba.nps.gov\Science\Data\Oceanography\\Data\yyyy\Plot\Hex\
----------------------------------------------------------
```

3. #5_hex_plot_2014.txt tells the sbebatch.exe application what processes to execute in what order.

```
datcnv /i%1hex_raw\*.hex /o%1plot\hex\temp /c%1con_calibration\%2
/p#5_HEX_to_CNV_for_Plotting_2014.psa /s
seaplot /i%1plot\hex\temp\*.cnv /o%1plot\hex /p#5_HEX_Plot_A_2014.psa /s
seaplot /i%1plot\hex\temp\*.cnv /o%1plot\hex /p#5_HEX_Plot_B_2014.psa /s
```

4. #5_HEX_to_CNV_for_Plotting_2014.psa informs the datcnv.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Data_Conversion >
  <Version value="7.18c" />
  <ServerName value="Data Conversion" />
  <InstrumentPath
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\con_calibration\5_6353.co
n" />
  <InstrumentMatch value="0" />
  <InputDir value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\hex_raw" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\plot\hex\temp" />
  <NameAppend value="" />
  <OutputFile value="" />
  <LastProcessed value="2" />
  <ProcessScansToEnd value="1" />
  <ScansToSkip value="180" />
  <ScansToProcess value="1" />
  <MergeHeaderFile value="0" />
  <OutputFormat value="0" high="1" low="0" initialValue="0" />
  <FromCast value="1" high="1" low="0" initialValue="0" />
  <CreateFile value="0" high="2" low="0" initialValue="0" />
  <ScanRangeSource value="3" high="3" low="0" initialValue="3" />
  <ScanRangeOffset value="0.000000" />
  <ScanRangeDuration value="2.000000" />
  <CalcArray Size="10" >
    <CalcArrayItem index="0" CalcID="15" >
      <Calc UnitID="54" Ordinal="0" >
        <FullName value="Density [sigma-t, Kg/m^3 ]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="17" >
      <Calc UnitID="31" Ordinal="0" >
        <FullName value="Depth [salt water, m]" />
        <Latitude value="58.500000" />
      </Calc>
    </CalcArrayItem>
```

```
    <CalcArrayItem index="2" CalcID="93" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, Wetlab ECO-AFL/FL [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="87" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="Upoly 0, Turbidity" />
        <CalcName value="Turbidity" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="70" >
      <Calc UnitID="49" Ordinal="0" >
        <FullName value="Salinity [PSU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="6" CalcID="97" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="7" CalcID="95" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="8" CalcID="55" >
      <Calc UnitID="40" Ordinal="0" >
        <FullName value="Oxygen, SBE 43 [ml/l]" />
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="9" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <MiscellaneousDataForCalculations >
    <Latitude value="58.500000" />
    <DescentRateAndAcceleration >
      <WindowSize value="2.000000" />
    </DescentRateAndAcceleration>
    <Oxygen >
      <WindowSize value="2.000000" />
      <ApplyHysteresisCorrection value="1" />
      <ApplyTauCorrection value="1" />
    </Oxygen>
    <AverageSoundVelocity >
      <MinimumPressure value="20.000000" />
      <MinimumSalinity value="20.000000" />
      <PressureWindowSize value="20.000000" />
      <TimeWindowSize value="60.000000" />
    </AverageSoundVelocity>
    <PlumeAnomaly >
      <ThetaB value="0.000000" />
      <SalinityB value="0.000000" />
      <ThetaZSalinityZRatio value="0.000000" />
      <ReferencePressure value="0.000000" />
    </PlumeAnomaly>
    <PotentialTempAnomaly >
      <A0 value="0.000000" />
      <A1 value="0.000000" />
      <A1Multiplier value="0" />
```

```
    </PotentialTempAnomaly>
  </MiscellaneousDataForCalculations>
</Data_Conversion>
```

5. #5_HEX_Plot_A_2014.psa informs seaplot.exe for generating the “A” series of profile plots.
   [content omitted due to length]

6. #5_HEX_Plot_B_2014.psa informs seaplot.exe for generating the “B” series of profile plots.
   [content omitted due to length]

I.6 CTD #5 CNV Files/Plots for Cruise Year 2014 and Beyond

Listed in order encountered.

1. #5_CNV_Create_2014.bat invokes the processing.

```
@echo off
rem This file is CNV_Create_2014.bat

type #5_cnv_create_2014.doc

rem Get year and cal file name-----------------------------------------
set /p sb-year=Enter 4-digit year:
set /p sb-cal=Enter calibration CON file name:

rem set environment -----------------------------------------------------
set path=%path%;C:\\Program Files\\sea-bird\\sbedataprocessing-win32
set sb-base-dir=\\files.glba.nps.gov\Science\Data\Oceanography\Data\%sb-year%\

rem invoke SBEBatch to make CNV from HEX and then plot the CNVs --------
sbebatch #5_CNV_Create_2014.txt %sb-base-dir% %sb-cal%
```

2. #5_CNV_Create_2014.doc notifies the user of what is about to happen.

```
---------------------------------------------------------------------
Generate OC_C CNV files from hex data files.
Your workstation must be connected to the NPS network.
Plot images of the CNV files are placed in
\\files.glba.nps.gov\Science\Data\Oceanography\Data\yyyy\Plot\CNV\.
Data files are in \\files.glba.nps.gov\Science\Data\Oceanography\Data\yyyy\CNV\.

This only works properly when using CTD #5: Sea-Bird19PlusV2 s/n 6353 on data collected
in 2014 and later.
---------------------------------------------------------------------
```

3. #5_CNV_Create_2014.txt tells the sbebatch.exe application what processes to execute in what order.

```
datcnv /i%1hex_raw\*.hex /o%1CNV_Processed\temp /c%1CON_calibration\%2
/p#5_CNV_Convert_2014.psa /s /a_C
Filter /i%1CNV_Processed\temp\*_C.cnv /o%1CNV_Processed\temp /p#5_CNV_Filter_2014.psa /s
/a_F
Alignctd /i%1CNV_Processed\temp\*_F.cnv /o%1CNV_Processed\temp /p#5_CNV_AlignCTD_2014.psa
/s /a_A
CellTM /i%1CNV_Processed\temp\*_A.cnv /o%1CNV_Processed\temp /p#5_CNV_CellTM_2014.psa /s
/a_M
Loopedit /i%1CNV_Processed\temp\*_M.cnv /o%1CNV_Processed\temp /p#5_CNV_LoopEdit_2014.psa
/s /a_L
Derive /i%1CNV_Processed\temp\*_L.cnv /o%1CNV_Processed\temp /c%1CON_calibration\%2
/p#5_CNV_Derive_2014.psa /s /a_D
Binavg /i%1CNV_Processed\temp\*_D.cnv /o%1CNV_Processed /p#5_CNV_Binavg_2014.psa /s /a_B
```

```
Seaplot /i%1CNV_Processed\*.cnv /o%1plot\cnv /p#5_CNV_Plot_A_2014.psa /s
Seaplot /i%1CNV_Processed\*.cnv /o%1plot\cnv /p#5_CNV_Plot_B_2014.psa /s
```

4. #5_CNV_convert_2014.psa informs the datcnv.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Data_Conversion >
  <Version value="7.22.2" />
  <ServerName value="Data Conversion" />
  <InstrumentPath
value="C:\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CON_calibration\SBE19plu
sV2_6353.xmlcon" />
  <InstrumentMatch value="0" />
  <InputDir value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\HEX_raw" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_processed\temp" />
  <NameAppend value="_C" />
  <OutputFile value="1302_5_0222_02.cnv" />
  <LastProcessed value="0" />
  <ProcessScansToEnd value="1" />
  <ScansToSkip value="180" />
  <ScansToProcess value="1" />
  <MergeHeaderFile value="0" />
  <OutputFormat value="0" high="1" low="0" initialValue="0" />
  <FromCast value="1" high="1" low="0" initialValue="0" />
  <CreateFile value="0" high="2" low="0" initialValue="0" />
  <ScanRangeSource value="3" high="3" low="0" initialValue="3" />
  <ScanRangeOffset value="0.000000" />
  <ScanRangeDuration value="2.000000" />
  <StartTimeOption value="0" />
  <PromptForNoteAndOrStartTime value="0" />
  <CalcArray Size="7" >
    <CalcArrayItem index="0" CalcID="93" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, WET Labs ECO-AFL/FL [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="150" >
      <Calc UnitID="45" Ordinal="0" >
        <FullName value="Turbidity, WET Labs ECO [NTU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="97" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="95" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="57" >
      <Calc UnitID="63" Ordinal="0" >
        <FullName value="Oxygen raw, SBE 43 [V]" />
        <ApplyHysteresisCorrection value="1" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="6" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
    </CalcArrayItem>
```

```
    </CalcArray>
    <MiscellaneousDataForCalculations >
      <Latitude value="58.500000" />
      <DescentRateAndAcceleration >
        <WindowSize value="2.000000" />
      </DescentRateAndAcceleration>
      <Oxygen >
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Oxygen>
      <AverageSoundVelocity >
        <MinimumPressure value="20.000000" />
        <MinimumSalinity value="20.000000" />
        <PressureWindowSize value="20.000000" />
        <TimeWindowSize value="60.000000" />
      </AverageSoundVelocity>
      <PlumeAnomaly >
        <ThetaB value="0.000000" />
        <SalinityB value="0.000000" />
        <ThetaZSalinityZRatio value="0.000000" />
        <ReferencePressure value="0.000000" />
      </PlumeAnomaly>
      <PotentialTempAnomaly >
        <A0 value="0.000000" />
        <A1 value="0.000000" />
        <A1Multiplier value="0" />
      </PotentialTempAnomaly>
    </MiscellaneousDataForCalculations>
  </Data_Conversion>
```

5. #5_CNV_filter_2014.psa informs the filter.exe application.

```
<?xml version="1.0" encoding="UTF-8"?>
<Filter >
  <Version value="7.22.2" />
  <ServerName value="Filter" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_Processed\temp" />
  <NameAppend value="_F" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <TimeConstFilterA value="0.500000" />
  <TimeConstFilterB value="1.000000" />
  <CalcArray Size="7" >
    <CalcArrayItem index="0" CalcID="93" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, WET Labs ECO-AFL/FL [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="150" >
      <Calc UnitID="45" Ordinal="0" >
        <FullName value="Turbidity, WET Labs ECO [NTU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="97" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="95" >
```

```
        <Calc UnitID="3" Ordinal="0" >
          <FullName value="Pressure, Strain Gauge [db]" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="5" CalcID="57" >
        <Calc UnitID="63" Ordinal="0" >
          <FullName value="Oxygen raw, SBE 43 [V]" />
          <ApplyHysteresisCorrection value="1" />
        </Calc>
      </CalcArrayItem>
      <CalcArrayItem index="6" CalcID="12" >
        <Calc UnitID="58" Ordinal="0" >
          <FullName value="Conductivity [S/m]" />
        </Calc>
      </CalcArrayItem>
    </CalcArray>
    <FilterTypeArray >
      <ArrayItem index="0" value="0" />
      <ArrayItem index="1" value="0" />
      <ArrayItem index="2" value="0" />
      <ArrayItem index="3" value="1" />
      <ArrayItem index="4" value="2" />
      <ArrayItem index="5" value="0" />
      <ArrayItem index="6" value="1" />
    </FilterTypeArray>
  </Filter>
```


6. #5_CNV_alignCTD_2014.psa informs the alignctd.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Align_CTD >
  <Version value="7.22.2" />
  <ServerName value="Align CTD" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_Processed\temp" />
  <NameAppend value="_A" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <CalcArray Size="7" >
    <CalcArrayItem index="0" CalcID="93" >
      <Calc UnitID="38" Ordinal="0" >
        <FullName value="Fluorescence, WET Labs ECO-AFL/FL [mg/m^3]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="150" >
      <Calc UnitID="45" Ordinal="0" >
        <FullName value="Turbidity, WET Labs ECO [NTU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="59" >
      <Calc UnitID="-1" Ordinal="0" >
        <FullName value="PAR/Irradiance, Biospherical/Licor" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="97" >
      <Calc UnitID="6" Ordinal="0" >
        <FullName value="Temperature [ITS-90, deg C]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="4" CalcID="95" >
      <Calc UnitID="3" Ordinal="0" >
        <FullName value="Pressure, Strain Gauge [db]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="5" CalcID="57" >
      <Calc UnitID="63" Ordinal="0" >
```

```
        <FullName value="Oxygen raw, SBE 43 [V]" />
        <ApplyHysteresisCorrection value="1" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="6" CalcID="12" >
      <Calc UnitID="58" Ordinal="0" >
        <FullName value="Conductivity [S/m]" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <ValArray size="7" >
    <ValArrayItem index="0" value="0.000000" variable_name="Fluorescence, WET Labs ECO-
AFL/FL" />
    <ValArrayItem index="1" value="0.000000" variable_name="Turbidity, WET Labs ECO" />
    <ValArrayItem index="2" value="0.000000" variable_name="PAR/Irradiance,
Biospherical/Licor" />
    <ValArrayItem index="3" value="0.500000" variable_name="Temperature" />
    <ValArrayItem index="4" value="0.000000" variable_name="Pressure, Strain Gauge" />
    <ValArrayItem index="5" value="5.000000" variable_name="Oxygen raw, SBE 43" />
    <ValArrayItem index="6" value="0.000000" variable_name="Conductivity" />
  </ValArray>
</Align_CTD>
```


7. #5_CNV_cellTM_2014.psa informs the celltm.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Cell_Thermal_Mass >
  <Version value="7.18c" />
  <ServerName value="Cell Thermal Mass" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_processed\temp" />
  <NameAppend value="_M" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <Primary >
    <Correct value="1" />
    <TempSensor value="0" />
    <TA_Amplitude value="0.040000" />
    <TA_TimeConstant value="8.000000" />
  </Primary>
  <Secondary >
    <Correct value="0" />
    <TempSensor value="1" />
    <TA_Amplitude value="0.030000" />
    <TA_TimeConstant value="7.000000" />
  </Secondary>
</Cell_Thermal_Mass>
```


8. #5_CNV_loopedit_2014.psa informs the loopedit.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Loop_Edit >
  <Version value="7.18c" />
  <ServerName value="Loop Edit" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2014\CNV_processed\temp" />
  <NameAppend value="_L" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <MinVelocityType value="0" high="1" low="0" initialValue="0" />
```

```
  <MinCTD_Velocity value="0.100000" />
  <TimeWindowSize value="300.000000" />
  <PercentMeanSpeed value="20.000000" />
  <ExcludeMarkedBad value="1" />
  <RemoveSurfaceSoak value="0" />
  <UseDeckPressure value="1" />
  <SurfaceSoakDepth value="10.000000" />
  <SurfaceSoakDepthMin value="5.000000" />
  <SurfaceSoakDepthMax value="20.000000" />
</Loop_Edit>
```


9. #5_CNV_derive_2014.psa informs the derive.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Derive >
  <Version value="7.18c" />
  <ServerName value="Derive" />
  <InstrumentPath
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CON_calibration\5_6353.co
n" />
  <InstrumentMatch value="0" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2010\CNV_processed\temp" />
  <NameAppend value="_D" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <CalcArray Size="4" >
    <CalcArrayItem index="0" CalcID="15" >
      <Calc UnitID="54" Ordinal="0" >
        <FullName value="Density [sigma-t, Kg/m^3 ]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="1" CalcID="70" >
      <Calc UnitID="49" Ordinal="0" >
        <FullName value="Salinity [PSU]" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="2" CalcID="17" >
      <Calc UnitID="31" Ordinal="0" >
        <FullName value="Depth [salt water, m]" />
        <Latitude value="58.500000" />
      </Calc>
    </CalcArrayItem>
    <CalcArrayItem index="3" CalcID="55" >
      <Calc UnitID="40" Ordinal="0" >
        <FullName value="Oxygen, SBE 43 [ml/l]" />
        <WindowSize value="2.000000" />
        <ApplyHysteresisCorrection value="1" />
        <ApplyTauCorrection value="1" />
      </Calc>
    </CalcArrayItem>
  </CalcArray>
  <MiscellaneousDataForCalculations >
    <Latitude value="58.500000" />
    <DescentRateAndAcceleration >
      <WindowSize value="2.000000" />
    </DescentRateAndAcceleration>
    <Oxygen >
      <WindowSize value="2.000000" />
      <ApplyHysteresisCorrection value="1" />
      <ApplyTauCorrection value="1" />
    </Oxygen>
    <AverageSoundVelocity >
      <MinimumPressure value="20.000000" />
      <MinimumSalinity value="20.000000" />
      <PressureWindowSize value="20.000000" />
```

```
      <TimeWindowSize value="60.000000" />
    </AverageSoundVelocity>
    <PlumeAnomaly >
      <ThetaB value="0.000000" />
      <SalinityB value="0.000000" />
      <ThetaZSalinityZRatio value="0.000000" />
      <ReferencePressure value="0.000000" />
    </PlumeAnomaly>
    <PotentialTempAnomaly >
      <A0 value="0.000000" />
      <A1 value="0.000000" />
      <A1Multiplier value="0" />
    </PotentialTempAnomaly>
  </MiscellaneousDataForCalculations>
</Derive>
```


10. #5_CNV_binavg_2014.psa informs the binavg.exe application.


```
<?xml version="1.0" encoding="UTF-8"?>
<Bin_Average >
  <Version value="7.18c" />
  <ServerName value="Bin Average" />
  <InputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_Processed\temp" />
  <InputFileArray size="0" GrowBy="-1" >
  </InputFileArray>
  <OutputDir
value="\\files.glba.nps.gov\Science\Data\Oceanography\Data\2013\CNV_processed" />
  <NameAppend value="_B" />
  <OutputFile value="" />
  <LastProcessed value="0" />
  <BinType value="2" />
  <BinSize value="1.000000" />
  <IncludeNumberScans value="0" />
  <ExcludeMarkedBad value="1" />
  <ScansToSkip value="0" />
  <CastToProcess value="1" high="2" low="0" initialValue="0" />
  <IncludeSurfaceBin value="1" />
  <SurfaceBinMinVal value="0.200000" />
  <SurfaceBinMaxVal value="0.800000" />
  <SurfaceBinVal value="0.000000" />
</Bin_Average>
```


11. #5_CNV_Plot_A_2014.psa informs seaplot.exe for generating the “A” series of profile plots.

```
[content omitted due to length]
```

12. #5_CNV_Plot_B_2014.psa informs seaplot.exe for generating the “B” series of profile plots.

```
[content omitted due to length]
```

Appendix J. Detailed Deliverable Definitions

Deliverables are the data and information products that are validated, certified, archived, and disseminated through the Southeast Alaska Network. Scientific deliverables are typically built by the Project Leader and submitted to the Data Manager. A few technical deliverables, which are typically built using automated applications, are generated by the Data Manager. Regardless of the source, every deliverable is formally validated by the Data Manager and certified by the originator before it is made available to SEAN's customers.

In order to carry out these processes, it is necessary to define in full detail the content, nature, and domain of each deliverable. Complete definitions also support subsequent interpretation of the products by removing ambiguity.

Appendix J defines every deliverable supported by the SEAN oceanographic program. It follows policies set in the SEAN Data Management Plan (Johnson and Moynahan 2008, SOP 302: Data Management Considerations in Protocol Development). Using that method, the top level description of a deliverable is explained using a single form named either A, B, C, or D. The specific form used for a particular deliverable depends on the nature of the deliverable's contents. Deliverables of a tabular type are further defined with a form X, where the structure of the table is described. Each individual attribute (i.e., column, field) of a table is then defined in detail using a form Y. Using this set of six forms, all data and information involved in the SEAN oceanographic program (and other SEAN programs) are consistently, precisely, and fully defined.

Each deliverable is also documented with a data flow diagram. These diagrams explain exactly where underlying data come from, what processes are applied to them, where they are stored, and who is responsible for performing each task used to create and update them.

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J.1 OC_A: CON Calibration Files

Purpose of Deliverable

CTD sensors are periodically calibrated. The unit as a whole is generally calibrated annually, although special circumstances may cause individual sensors to be recalibrated and reported *ad hoc*. Calibration results in a report for each sensor that provides numeric factors used to adjust actual field readings to a standardized level. A full CTD calibration typically results in the vendor providing a CON or XMLCON computer file covering multiple sensors. When ad hoc calibration of just one particular sensor is performed, results are typically provided on paper. These paper factors must then be added to the latest CON or XMLCON file using proprietary software. The ultimate deliverable, a calibration file, is used by subsequent processes to normalize field data. Providing this deliverable allows customers to generate processed CNV data from raw readings, replicate our program results, and investigate new methods of processing raw CTD data.

Frequency Produced

A new calibration file must be created after the result of any sensor recalibration is reported to the Project Leader. Note there are different process steps for handling a file provided for the CTD than there are for handling a paper report on an individual sensor.

Prerequisites

Validation cannot be performed until the corresponding OC_G calibration certificate images have been certified.

Data Flow

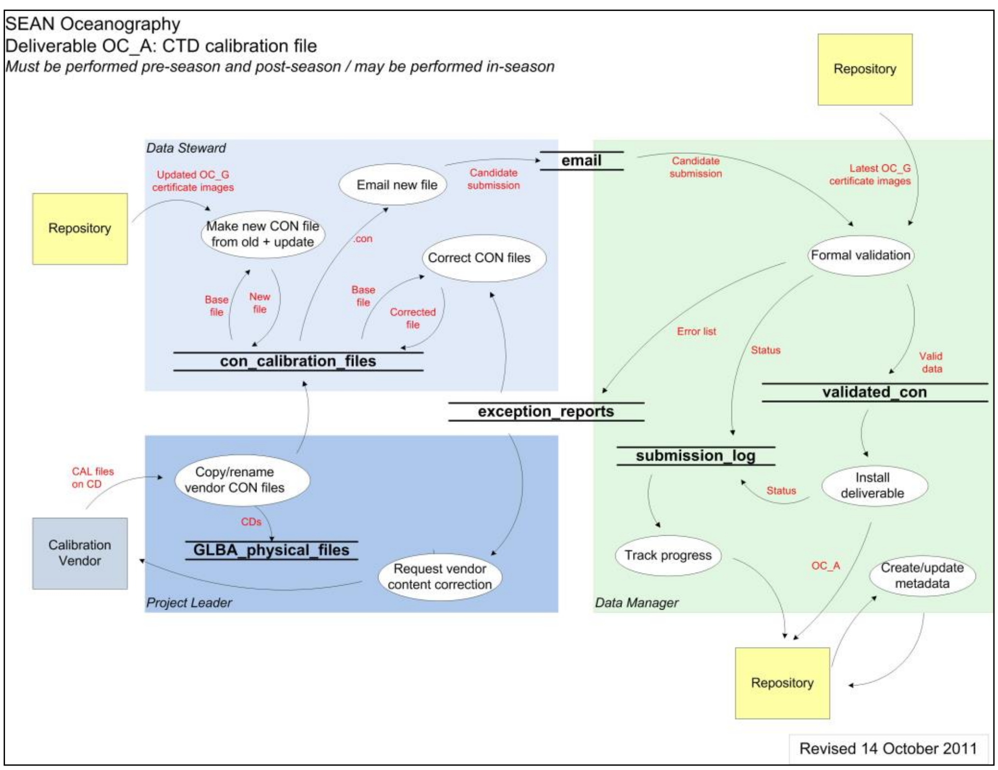


Figure J.1. Data flow required to generate deliverable OC_A: CON files.

Deliverable Definition Forms

Form C: Nontabular Data Deliverable

Vital Sign: OC Oceanography	*Deliverable ID:* OC_A	*Deliverable Title:* CON calibration files
File format: CON or XMLCON	*Associated software and version*: SBEDataProc.exe 7.22	*Revision Date / protocol version:* 02-07-2014 / OC-2014.1
Expected frequency: one per CTD per year	*Likely dissemination partners:* None: served by SEAN	*Submission unit:* CTD#+Year+Month
What purpose does this deliverable serve? Documents the calibration parameters for all sensors on the CTD. Needed to convert raw HEX data into binned engineering-unit CNV data (using the SBEDataProc program).		
Summary of content: This file uses a proprietary format. Each type of sensor requires different kinds of calibration parameters. The file contains a section for each sensor, as identified by sensor serial number. Within each section are the particular parameters appropriate to that sensor. There is also a general CTD configuration section that defines such items as the number of channels installed. The internal file format named using extension CON was employed by SEAN through 2013. The XMLCON format was used beginning in 2014. There is basically no difference in functionality between the two. For simplicity, the protocol uses the term CON to refer to either file type. The file is named using the convention C_YYMM.CON (or C_YYMM.XMLCON) where C is the single-digit CTD identifier, YY are the last two digits of the highest calendar year in the file in which any sensor was calibrated, and MM are the two-digit month of the most recent sensor calibration in the file.		
Mandatory validation criteria: 1. Must be able to be opened, updated, and resaved using the Config function of SBEDataproc.exe 7.22 or later. 2. Values must match those in corresponding OC_G images from the same time period.		
Optional validation criteria: None		
Deliverable ID of any other SEAN data products required to create this product: OC_G CTD calibration certificate images		
Description and source of any outside data required to create this product: Periodic calibration is performed by Sea-Bird Electronics, typically at the end of each season. They supply a new CON/XMLCON file after each service event. Some sensors may be revised during the season. In this case, PDF documentation is provided to permit the Data Steward to locally produce an updated CON/XMLCON file.		

J.2 OC_B: Raw HEX Files

Purpose of Deliverable

CTD devices collect sensor data in memory, grouped by cast. These raw “hex” data are downloaded from the CTD into ASCII files containing header information and hexadecimal representations of sensor voltages and frequencies taken at a preset time interval. Each cast is recorded in one and only one hex file. Typically, OC_B hex files are later processed into advanced products that are binned by depth with voltages converted to appropriate engineering units (see deliverable OC_C). However, the raw OC_B deliverables are made available to the community in order to support custom analyses that require raw sensor data.

Frequency Produced

Data in HEX format are produced for every cast, as delineated by the cycling of the CTD’s on/off switch. The data are unloaded into hex files at the end of each cruise day. Hex files are accumulated during the season. OC_B is created at the end of each season by packaging all component hex files into a single deliverable.

Prerequisites

Production of this deliverable is dependent on capturing the daily CTD data stream into intermediate files throughout the season. The final deliverable is created postseason from the saved in-season data files.

Data Flow

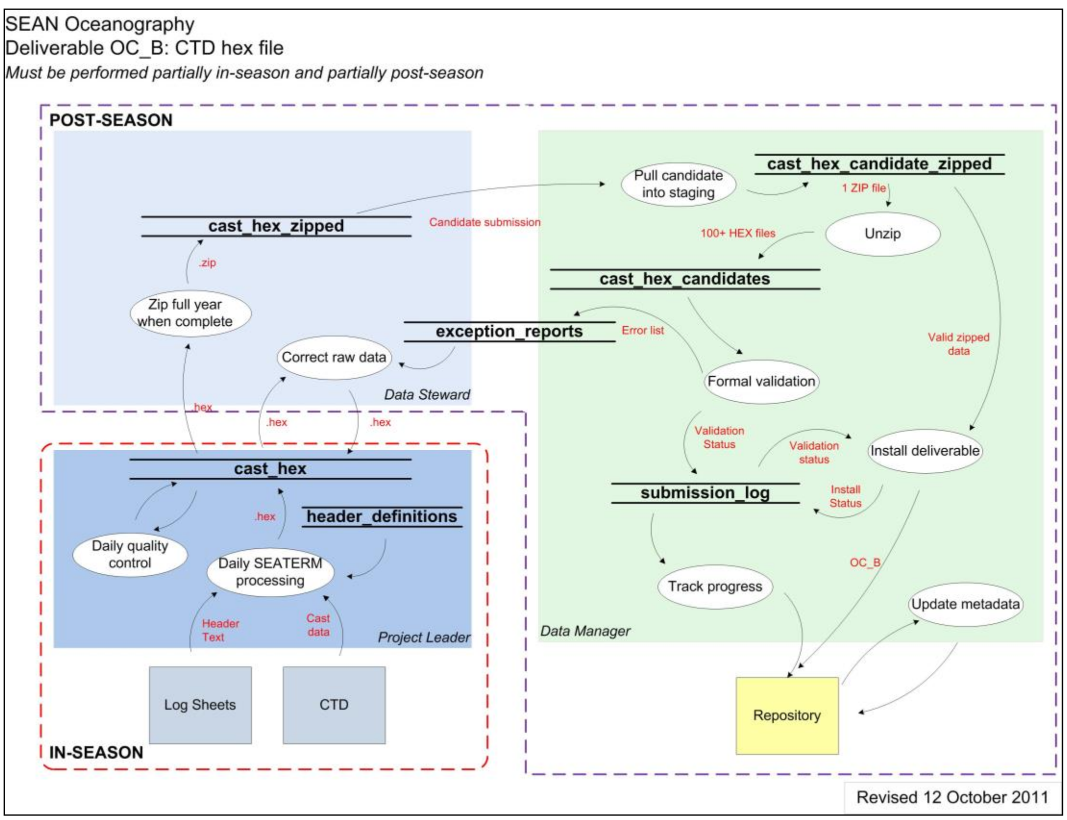


Figure J.2. Data flow required to generate deliverable OC_B: HEX files.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

Vital Sign: OC Oceanography	*Deliverable ID:* OC_B	*Deliverable Title:* Raw HEX files
File format: ZIP	*Associated software and version*: PKUNZIP, WINRAR, etc.	*Revision Date / protocol version:* 01-15-2014 / OC-2014.1
Expected frequency: 1 zip holding about 120 hex files/year	*Likely dissemination partners:* None – served by SEAN	*Submission unit:* YEAR
What purpose does this deliverable serve? Provides raw CTD “hex” data to inform customer analyses.		
Identifiers of relations that compose the tabular deliverable (“relations” are tables or files that provide information that may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X): HEX_YYYY.ZIP is a .ZIP archive of individual cast files named “YYMM_C_DDDD_cc.HEX”, where YY is year of cast, MM is month of cast, C is local CTD number, DDDD is dump number, and cc is cast number. Leading zeroes are used to make every filename exactly 18 characters.		
Deliverable ID of any other SEAN data products required to create this product: None		
Description and source of any outside data required to create this product: Individual cast data from CTD downloads. Field log sheets recording cast particulars. SeaTerm program configuration file containing the header prompt definitions explained in Appendix G must be available.		

Form X: Relation Definition

Vital Sign: OC Oceanography	*Relation identifier:* YYMM_C_DDDD_cc.HEX	*Used by deliverable ID:* OC_B
Revision date / protocol version: 04-08-2009 / OC-2014.1	*Type of relation:* ○ Database table ◉ Data file	*Estimated rows:* 1,200
Primary key for this relation: None		
Purpose: Oceanographic cast raw "hex" data downloaded from CTD.		
Identifiers of attributes defined over this relation ("attributes" are columns of the grid. Each attribute must be defined in an accompanying Form Y): LINE		
Mandatory validation criteria involving multiple attributes: None		
Optional validation criteria involving multiple attributes: None		

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute identifier:* LINE	*Used by deliverable ID:* OC_B
Revision Date / Protocol Version: 04-08-2009 / OC-2014.1	*Default report heading:* None	*Relation (from Form X):* YYMM_C_DDDD_cc.HEX
Purpose: One proprietary data line from the CTD device during a cast.		

Data type:	varchar()
Maximum length:	200
Required:	no
Measurement units:	n/a
Format:	Character string
Foreign key to (relation+attribute):	n/a
Case:	Upper only
Mandatory validation rules for this attribute (in order of application):	1. Null LINE is always valid. 2. LINE having first character of "*" is always valid. 3. LINE must be composed of characters from the set {A–Z} + {0–9}. Lower case is not permitted. 4. Every LINE in the file, other than those beginning with "*", must be exactly the same number of characters long. For example, all must be 24 characters in a particular file. 5. Within the relation as a whole, each of the following strings must be present in at least one LINE beginning "**": "Vessel:", "CTD#:", "Dump#:", "Observer:", "Cast#:", "Station:", "Latitude:", "Longitude:", "Date GMT:", "Time GMT:", "Fathometer depth:", "Cast target depth:".
Optional validation rules for this attribute:	Count the number of lines following the delimiter line "*END*". This should match the number of samples determined by parsing the line beginning "* cast" and locating starting and ending record number.

J.3 OC_C: Processed CNV Files

Purpose of Deliverable

The CNV files show the recorded parameters for each cast in a manner useful for analysis. Each processed CNV is derived from a HEX file, but differs in three ways. First, the CNV data shows one row for every meter of depth; while HEX data typically show multiple rows for every meter, because HEX readings are taken at periodic times instead of periodic depths. Second, CNV values have been normalized using the calibration factors. Third, CNV values are in terms of engineering units instead of voltage or frequency levels.

Frequency Produced

OC_C is created at the end of each season by generating a CNV file for each HEX file and then packaging all CNV files into a single deliverable.

Prerequisites

Production of this deliverable is dependent on having certified OC_A and OC_B products for the season.

Data Flow

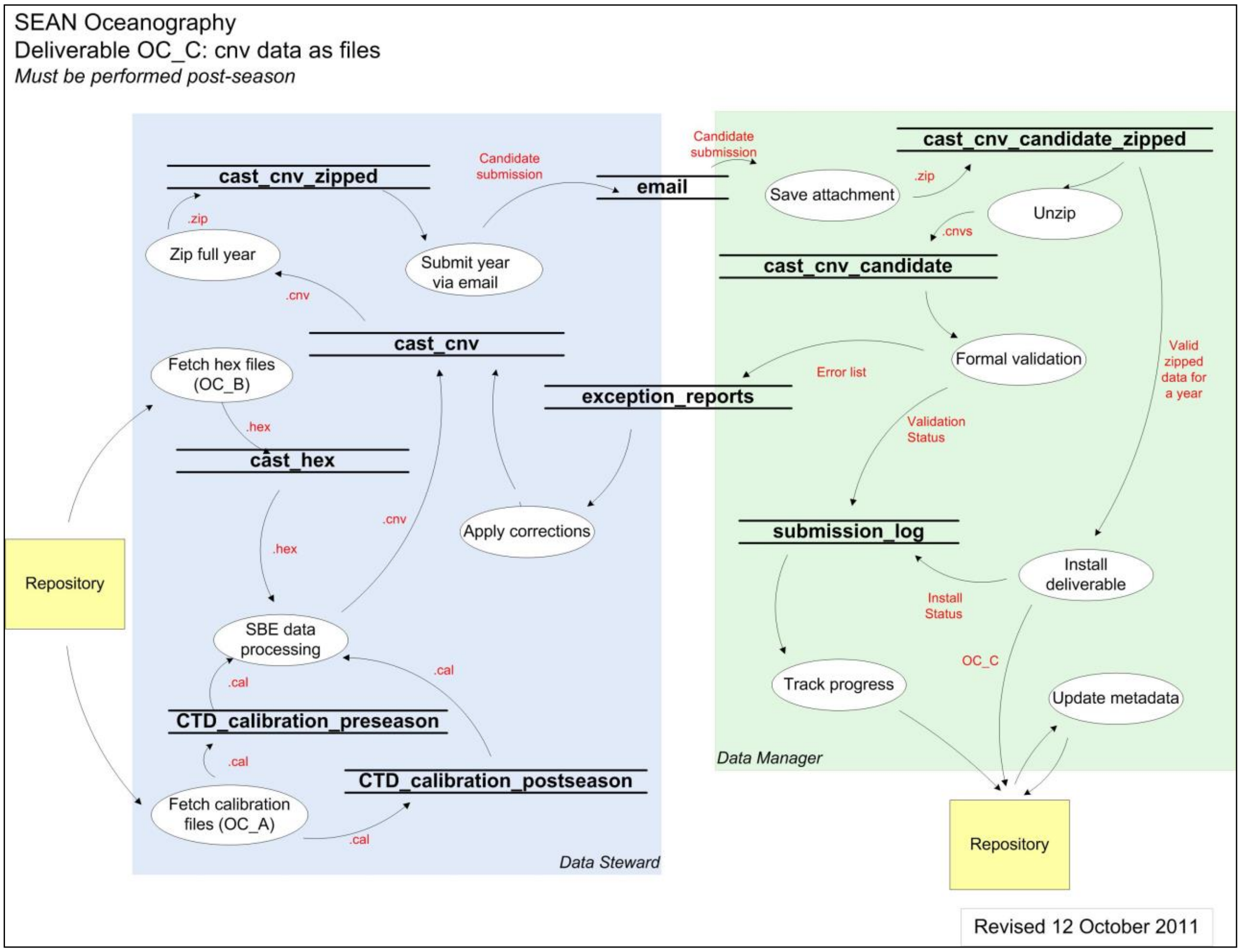


Figure J.3. Data flow required to generate deliverable OC_C: CNV files.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

<table>
<tr><td>Vital Sign:
OC Oceanography</td><td>Deliverable ID:
OC_C</td><td>Deliverable Title:
Processed CNV files</td></tr>
<tr><td>File format:
ZIP</td><td>Associated software and version:
PKUNZIP, WINRAR, etc.</td><td>Revision Date / protocol version:
04-09-2009 / OC-2014.1</td></tr>
<tr><td>Expected frequency:
one ZIP holding about 120 HEX files/year</td><td>Likely dissemination partners:
None: served by SEAN</td><td>Submission unit:
YEAR</td></tr>
<tr><td colspan="3">What purpose does this deliverable serve?
Provides binned, calibrated CNV data for customer analyses.</td></tr>
<tr><td colspan="3">Identifiers of relations that compose the tabular deliverable (“relations” are tables or files that provide information that may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X):
CNV_YYYY.ZIP is a zip archive of individual cast files named “YYMM_C_DDDD_cc.CNV”, where YY is year of cast, MM is month of cast, C is local ctd number, DDDD is dump number, and cc is cast number. Leading zeroes are used to make every filename exactly 18 characters. The CNV files are considered a relation for purposes of data management.</td></tr>
<tr><td colspan="3">Deliverable ID of any other SEAN data products required to create this product:
1. OC_B HEX files for the year of interest.
2. The most recent OC_A CON file whose latest individual sensor calibrations fall before the earliest cast represented in the OC_B files. That is, say, if OC_B covers 1/15/2006 through 9/22/2006 then the OC_A CON file to use must have no individual sensor calibration date exceeding 1/15/2006. The OC_A naming convention usually allows ascertaining the correct file to use at a glance.</td></tr>
<tr><td colspan="3">Description and source of any outside data required to create this product:
None</td></tr>
</table>

Form X: Relation Definition

Vital Sign: OC Oceanography	*Relation identifier:* YYMM_C_DDDD_cc.cnv	*Used by deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Type of relation:* ○ Database table ◉ Data file	*Estimated rows:* 180

Primary key for this relation:
None

Purpose:
Oceanographic cast CNV data for customer analysis. The file consists of a preamble defining parameters involved in the cast such as station and dump number. This is followed by a second preamble that documents the processing performed to create this cast data. The final section is a grid of attributes with each row representing a meter in the downcast.

Identifiers of attributes defined over this relation (“attributes” are columns of the grid. Each attribute must be defined in an accompanying Form Y):

PRESSURE	FLUORESCENCE
DEPTH	OBS
TEMPERATURE	OXYGEN
CONDUCTIVITY	PAR
SALINITY	SBE_DATA_FLAG
SIGMA_T	

Mandatory validation criteria involving multiple attributes:

1. Any record whose first character is either “*” or “#” is preamble data that is always valid, no validation of individual attributes applies to such rows.
2. Within the relation as a whole, each of the following strings must be present in at least one row beginning with the “*” character:
   “Vessel:”, “CTD#:”, “Dump#:”, “Observer:”, “Cast#:”, “Station:”, “Latitude:”, “Longitude:”, “Date GMT:”, “Time GMT:”, “Fathometer depth:”, “Cast target depth:”

Optional validation criteria involving multiple attributes:
None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* PRESSURE	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Pressure (dbar)	*Relation (from Form X):* yymm_C_dddd_cc.cnv
Purpose: Pressure in decibars.		

Data type:	real
Maximum length	8
Required:	yes
Measurement units:	decibars
Format:	9999.9999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between -0.002 and 9999.9999
Optional validation rules for this attribute:	1. Should be between 1 and 800

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* DEPTH	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Depth (m)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Depth in meters.		

Data type:	integer
Maximum length	4
Required:	yes
Measurement units:	meters
Format:	9999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be an integer. 2. Must be between 0 and 9999. 3. Must be unique within a file.
Optional validation rules for this attribute:	1. Should be between 0 and 800.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* TEMPERATURE	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Temperature (C)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Temperature in Celsius.		

Data type:	real
Maximum length	6
Required:	no
Measurement units:	degrees C
Format:	99.9999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between -5.0 and 20.0. 3. Special allowed case of SBE error flag value: -9.990e-29 .
Optional validation rules for this attribute:	1. Should be between 0.0 and 20.0

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* CONDUCTIVITY	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Conductivity (S/m)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Conductivity in Siemens per meter.		

Data type:	real
Maximum length	8
Required:	no
Measurement units:	Siemens/meter
Format:	9.999999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 10.0. 3. Special allowed case of SBE error flag value: -9.990e-29.
Optional validation rules for this attribute:	1. Should be between 0.0 and 5.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* SALINITY	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Salinity (PSU)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Salinity in practical salinity units.		

Data type:	real
Maximum length	6
Required:	no
Measurement units:	PSU
Format:	99.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 40.0. 3. Special allowed case of SBE error flag value: -9.990e-29.
Optional validation rules for this attribute:	1. Should be between 0.0 and 34.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* SIGMA_T	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Density (kg/m³)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Density differential in kg/m³.		

Data type:	real
Maximum length	7
Required:	no
Measurement units:	kg/m³
Format:	99.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 30.0. 3. Special allowed case of SBE error flag value: -9.990e-29.
Optional validation rules for this attribute:	1. Should be between 15.0 and 27.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier*: FLUORESCENCE	*Used by Deliverable ID*: OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading*: Fluorescence (mg/m**3)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Fluorescence.		

Data type:	real
Maximum length	6
Required:	no
Measurement units:	mg/m³
Format:	99.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 99.999. 3. Special allowed case of SBE error flag value: -9.990e-29.
Optional validation rules for this attribute:	1. Should be between 0.0 and 70.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* OBS	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Backscatterance (in NTU)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Turbidity detected by OBS backscatter sensor.		

Data type:	real
Maximum length	7
Required:	no
Measurement units:	NTU
Format:	999.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 800.0. 3. Special allowed case of SBE error flag value: -9.990e-29.
Optional validation rules for this attribute:	1. Should be between 0.0 and 500.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* OXYGEN	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Dissolved Oxygen (ml/l)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Dissolved oxygen content.		

Data type:	real
Maximum length	6
Required:	no
Measurement units:	ml/l
Format:	99.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 20.0. 3. Special allowed case of SBE error flag value: -9.990e-29.
Optional validation rules for this attribute:	1. Should be between 2.0 and 14.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* PAR	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 04-09-2009 / OC-2014.1	*Default Report Heading:* PAR (uE/m^2 * sec)	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv
Purpose: Photosynthetically active radiation.		

Data type:	real
Maximum length	8
Required:	no
Measurement units:	μEinsteins/m^2·sec
Format:	9999.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 3000.0. 3. Special allowed case of SBE error flag value: -9.990e-29.
Optional validation rules for this attribute:	1. Should be between 0.0 and 1600.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* SBE_DATA_FLAG	*Used by Deliverable ID:* OC_C
Revision date / protocol version: 01-15-2014 / OC-2014.1	*Default Report Heading:* DP Quality	*Relation (from Form X):* YYMM_C_DDDD_cc.cnv

Purpose:
Indicates bins with suspect data due to pressure slowdown or reversal as drop progresses. Set appropriately by SBE data processing “loopedit” function. A nonzero value indicates an invalid data row, which will not be loaded into the OC_D database. This may also be set manually in order to disqualify a particular row judged to contain unusable data. Note this refers to a column in the file and not the similarly referred to value “-9.990e-29” used to nullify certain individual parameter values in individual cells of a row.

Data type:	real
Maximum length	9
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	none
Optional validation rules for this attribute:	none

J.4 OC_D: Cumulative Database

Purpose of Deliverable

Working with large groups of OC_C processed CNV files can be cumbersome and difficult. An oceanography database is maintained that contains all the CNV values for all surveys done in the program. These rows may differ slightly from OC_C data in having data quality information, outlier corrections, etc. Through the web, the database may be queried to produce a single file on the customer's workstation containing final data, filtered to meet the customer's exact area of interest. Deliverable OC_D is an incremental update used to revise the cumulative database.

Frequency Produced

OC_D is generated at the end of each season directly after certification of OC_C processed CNV files. It is created from OC_C's intermediate validation files.

Prerequisites

Production of this deliverable is dependent on having a certified OC_C product for the year.

Data Flow

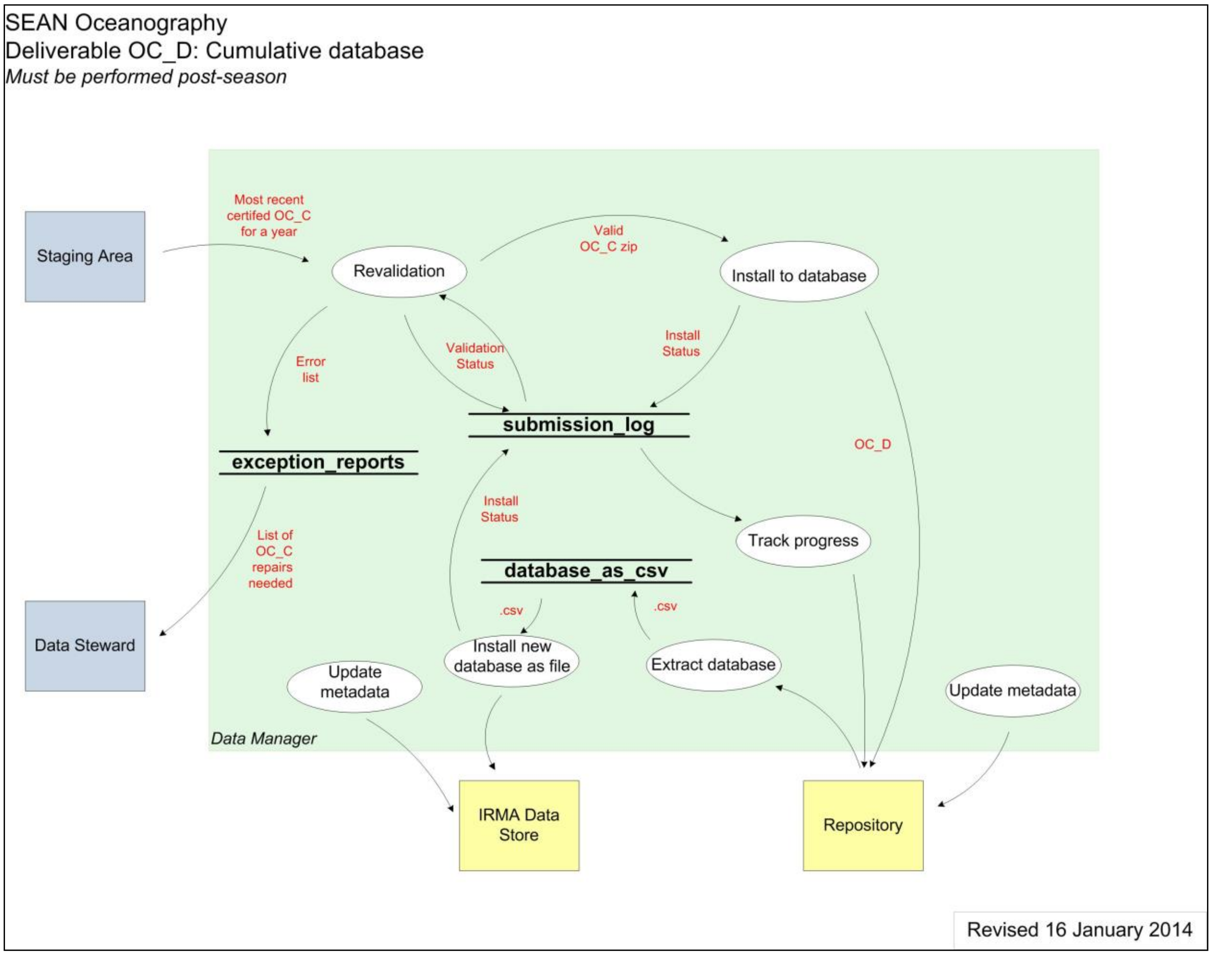


Figure J.4. Data flow required to generate deliverable OC_D: cumulative database.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

Vital Sign: OC Oceanography	*Deliverable ID:* OC_D	*Deliverable Title:* Cumulative database
File Format: n/a	*Associated software and version*: n/a	*Revision Date / protocol version:* 01-15-2014 / OC-2014.1
Expected Frequency: one submission/year	*Likely Dissemination Partners:* None: served by SEAN	*Submission Unit:* YEAR
What purpose does this deliverable serve? Provides binned, calibrated CNV data filtered by parameters directly to customer workstations. This is basically all years of deliverable OC_C recast in a database structure. Individual sensor data in the source CNV file that have negative values (typically due to faulty sensor or SBE data error flag) are treated as NULL in the database.		
Identifiers of relations that compose the tabular deliverable ("relations" are tables or files that provide information that may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X): tbl_oc_cast		
Deliverable ID of any other SEAN data products required to create this product: OC_C		
Description and source of any outside data required to create this product: None		

Form X: Relation Definition

Vital Sign: OC Oceanography	*Relation Identifier:* tbl_oc_cast	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 01-15-2014 / OC-2014.1	*Type of Relation:* Database Table	*Estimated Rows:* 370,000+

Natural key for this relation:
ctd + dump + cast + depth

Purpose:
Oceanographic calibrated cast data binned to 1 m levels and expressed in engineering units, to serve as a basis for customer analysis. The table is totally denormalized to facilitate web downloading and direct use by Excel and MS Access.

Identifiers of attributes defined over this relation ("attributes" are columns of the grid. Each attribute must be defined in an accompanying Form Y):

CTD	CONDUCTIVITY
DUMP	SALINITY
OBSERVER	SIGMA_T
CAST	FLUORESCENCE
VESSEL	OBS
STATION	OXYGEN
LATITUDE	PAR
LONGITUDE	SBE_DATA_FLAG
DATE_GMT	COMMENTS
TIME_GMT	DATA_QUALITY
FATHOMETER_DEPTH	QUALITY_COMMENT
TARGET_DEPTH	TIME_STAMP
PRESSURE	PROTOCOL_ID
DEPTH	USERID
TEMPERATURE	SUBMISSION_NUMBER
	CRUISE_YEAR

Mandatory validation criteria involving multiple attributes:
None

Optional validation criteria involving multiple attributes:
None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* CTD	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 01-15-2014 / OC-2014.1	*Default Report Heading:* CTD #	*Relation (from Form X):* tbl_oc_cast
Purpose: Local identification number of the CTD device, as designated in Appendix F.		

Data type:	Varchar(1)
Maximum length	1
Required:	yes
Measurement units:	n/a
Format:	9
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be between 1 and 9.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* DUMP	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 04-10-2009 / OC-2014.1	*Default Report Heading:* DUMP#	*Relation (from Form X):* tbl_oc_cast
Purpose: The sequential number that is incremented each time any CTD memory is cleared. It tracks distinct uses of the CTD to gather a set of consecutive casts.		

Data type:	Varchar(4)
Maximum length	4
Required:	yes
Measurement units:	n/a
Format:	0000
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must represent a whole number, zero filled.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* OBSERVER	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Observer	*Relation (from Form X):* tbl_oc_cast
Purpose: The last names of those making the cast.		

Data type:	Varchar(50)
Maximum length	50
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	any
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* CAST	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Cast#	*Relation (from Form X):* tbl_oc_cast
Purpose: Sequential cast number within a particular dump. Casts are integers beginning with zero. They are generated by the CTDs themselves. Because of memory limits in existing equipment, it is rare CAST will ever exceed 15. Cast is part of the primary key, making its representation critical. If its value is below 10, it must be stored only as two digits, employing a leading zero if needed.		

Data type:	Varchar(2)
Maximum length:	2
Required:	yes
Measurement units:	n/a
Format:	00
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must represent an integer between 0 and 99.
Optional validation rules for this attribute:	1. Should be between 0 and 15.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* VESSEL	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Vessel	*Relation (from Form X):* tbl_oc_cast
Purpose: Name of the vessel used to conduct the survey.		

Data type:	Varchar(24)
Maximum length:	24
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	Proper
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* STATION	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Station	*Relation (from Form X):* tbl_oc_cast
Purpose: Identification number for a unique sampling location. Over time station numbers may be retired. The numbers are never recycled. Stations are always exactly two digits in length, using a leading zero if needed to meet that constraint.		

Data type:	Varchar(2)
Maximum length:	2
Required:	yes
Measurement units:	n/a
Format:	00
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must represent a zero-filled integer between 00 and 24.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* LATITUDE	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Latitude	*Relation (from Form X):* tbl_oc_cast
Purpose: Decimal latitude in WGS84 datum.		

Data type:	real
Maximum length:	8
Required:	no
Measurement units:	degrees
Format:	99.99999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 58.0 and 61.0.
Optional validation rules for this attribute:	1. Should be within 0.05 degrees of identified station.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* LONGITUDE	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Longitude	*Relation (from Form X):* tbl_oc_cast
Purpose: Decimal longitude using the WGS84 datum.		

Data type:	real
Maximum length:	10
Required:	no
Measurement units:	n/a
Format:	-999.99999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between -135.0 and -142.0.
Optional validation rules for this attribute:	1. Should be within 0.05 degrees of identified station.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* DATE_GMT	*Used by Deliverable ID:* OC_D
Revision date / protocol version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Date	*Relation (from Form X):* tbl_oc_cast
Purpose: Date the cast was taken; in the GMT time zone.		

Data type:	date
Maximum length:	n/a
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a valid date. 2. Must not be a date beyond the current one at moment of validation. 3. Must not be a date before 1992.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* TIME_GMT	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Time	*Relation (from Form X):* tbl_oc_cast
Purpose: Time cast was initiated, in Greenwich Mean Time.		

Data type:	time
Maximum length:	n/a
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must resolve to a valid time.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* FATHOMETER_DEPTH	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Bottom (m)	*Relation (from Form X):* tbl_oc_cast
Purpose: Depth to the sea floor for this station in meters, expressed as a positive integer.		

Data type:	integer
Maximum length:	4
Required:	no
Measurement units:	meters
Format:	9999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be an integer between 0 and 9999.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* PRESSURE	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Pressure (dbar)	*Relation (from Form X):* tbl_oc_cast
Purpose: Pressure in decibars.		

Data type:	real
Maximum length:	8
Required:	no
Measurement units:	decibars
Format:	9999.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 1 and 9999.999.
Optional validation rules for this attribute:	1. Should be between 1 and 800.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* DEPTH	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 05-12-2010 / OC-2014.1	*Default Report Heading:* Depth (m)	*Relation (from Form X):* tbl_oc_cast

Purpose:
Depth of this bin in meters, expressed as a positive integer. The first bin is labeled as meter zero. NOTE: sampling mechanics sometimes prevent the first meter (or more) from being recorded. In such cases the missing surface bins are imputed by replicating the readings of the first valid bin up through bin 0 (provided there is a valid bin within 4 m of the surface). A comment explaining this is included on every imputed row. If no valid bin is present for a cast within the first 4 m, no rows are generated and the missing bins in OC_C remain missing in OC_D.

Data type:	integer
Maximum length:	4
Required:	yes
Measurement units:	meters
Format:	9999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be an integer. 2. Must be between 0 and 9999.
Optional validation rules for this attribute:	1. Should be less than 800.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* TEMPERATURE	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Temperature (C)	*Relation (from Form X):* tbl_oc_cast

Purpose:
Water temperature in degrees Celsius [ITS-90]

Data type:	Real
Maximum length:	6
Required:	no
Measurement units:	degrees C
Format:	99.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between -5.0 and 20.0.
Optional validation rules for this attribute:	1. Should be between 0.0 and 20.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* CONDUCTIVITY	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Conductivity (S/m)	*Relation (from Form X):* tbl_oc_cast
Purpose: Conductivity in Siemens per meter.		

Data type:	real
Maximum length	8
Required:	no
Measurement units:	Siemens/meter
Format:	9.999999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 10.0.
Optional validation rules for this attribute:	1. Should be between 0.0 and 5.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* SALINITY	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Salinity (PSU)	*Relation (from Form X):* tbl_oc_cast
Purpose: Salinity in practical salinity units.		

Data type:	real
Maximum length:	6
Required:	no
Measurement units:	PSU
Format:	99.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 40.0.
Optional validation rules for this attribute:	1. Should be between 0.0 and 34.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* SIGMA_T	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Density (kg/m³)	*Relation (from Form X):* tbl_oc_cast
Purpose: Density differential in kg/m³.		

Data type:	real
Maximum length:	7
Required:	no
Measurement units:	kg/m³
Format:	nn.nnn
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 30.0
Optional validation rules for this attribute:	1. Should be between 15.0 and 27.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* FLUORESCENCE	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Fluorescence (mg/m³)	*Relation (from Form X):* tbl_oc_cast
Purpose: Fluorescence, proxy for chlorophyll-a.		

Data type:	real
Maximum length:	6
Required:	no
Measurement units:	mg/m³
Format:	99.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be less than 100.0.
Optional validation rules for this attribute:	1. Should be between 0.0 and 70.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* OBS	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-09-2009 / OC-2014.1	*Default Report Heading:* Backscatterance (NTU)	*Relation (from Form X):* tbl_oc_cast
Purpose: Turbidity detected by OBS backscatter sensor.		

Data type:	real
Maximum length:	7
Required:	no
Measurement units:	NTU
Format:	999.999
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 800.0.
Optional validation rules for this attribute:	1. Should be between 0.0 and 500.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* OXYGEN	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Dissolved Oxygen (ml/l)	*Relation (from Form X):* tbl_oc_cast
Purpose: Dissolved oxygen content. Negative values may appear when CTD is used without the DO sensor securely connected.		

Data type:	real
Maximum length:	6
Required:	no
Measurement units:	ml/l
Format:	nn.nnn
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must not exceed 20.0.
Optional validation rules for this attribute:	1. Should be between 2.0 and 14.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* PAR	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-09-2009 / OC-2014.1	*Default Report Heading:* PAR (uE/m^2 * sec)	*Relation (from Form X):* tbl_oc_cast
Purpose: Photosynthetically active radiation.		

Data type:	real
Maximum length:	8
Required:	no
Measurement units:	µEinsteins/m²·sec
Format:	nnnn.nnn
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be a real number. 2. Must be between 0.0 and 3000.0.
Optional validation rules for this attribute:	1. Should be between 0.0 and 1600.0.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* SBE_DATA_FLAG	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* DP Error Flag	*Relation (from Form X):* tbl_oc_cast
Purpose: Indicates bins with suspect data due to pressure slowdown or reversal as the cast progresses. A nonzero value indicates suspect data, which is excluded from the database. In practice, this column is always 0 since input with other values is always rejected as the database is updated. It is kept here to maintain consistency with OC_C attributes.		

Data type:	real
Maximum length:	9
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* COMMENTS	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Comments	*Relation (from Form X):* tbl_oc_cast
Purpose: Recorded comments regarding circumstances of this particular cast.		

Data type:	Varchar(512)
Maximum length:	512
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* DATA_QUALITY	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Data Quality	*Relation (from Form X):* tbl_oc_cast
Purpose: Indicator of the quality of the observation, for determining whether to include it in analyses. The Ocean Data View coding system is observed. This is not recorded in the database during OC_D loading. Instead, it is entered upon subsequent certification of deliverable OC_M: Data Quality. 0 = good, 1 = unknown, 4 = questionable, 8 = bad. The DATA_QUALITY_COMMENT explains why a row is flagged 4 or 8. (See the OC_M entry for detailed explanation of quality codes.)		

Data type:	Varchar(1)
Maximum length:	1
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	tbl_data_quality
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. If present, must match 0, 1, 4, or 8.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* DATA_QUALITY_COMMENT	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Quality Comment	*Relation (from Form X):* tbl_oc_cast
Purpose: Explanation of why data quality was not considered "good." The source for this attribute is the certified OC_M spreadsheet product for the particular year.		

Data type:	Varchar(512)
Maximum length:	512
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* TIME_STAMP	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Last Updated	*Relation (from Form X):* tbl_oc_cast
Purpose: The date and time this row was most recently inserted or updated in the table. It is used for auditing purposes.		

Data type:	date and time
Maximum length:	n/a
Required:	yes
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	not validated; generated automatically
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* PROTOCOL_ID	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Protocol	*Relation (from Form X):* tbl_oc_cast
Purpose: The formal version of the protocol under which this row was created in the database.		

Data type:	Varchar(10)
Maximum length:	10
Required:	yes
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	SEAN.tbl_protocol.protocol
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must match a protocol value in database table tbl_protocol.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* USERID	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Updated by	*Relation (from Form X):* tbl_oc_cast
Purpose: The login name used to authorize the process that created/updated this row in the cumulative database. It is restricted to those userids stored in the database table called tbl_submitter. It is used for auditing purposes.		

Data type:	Varchar(20)
Maximum length:	20
Required:	yes
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	SEAN.tbl_submitter.submitter_userid
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must match a submitter_userid in tbl_submitter.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* SUBMISSION_NUMBER	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 04-10-2009 / OC-2014.1	*Default Report Heading:* Submission#	*Relation (from Form X):* tbl_oc_cast
Purpose: The submission number used to transmit to the network the files from which this particular row came. It is used for several data management purposes, including auditing.		

Data type:	int
Maximum length:	n/a
Required:	yes
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	SEAN.tbl_submission_log.submission_number
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must match a submission_number in tbl_submission_number.
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* CRUISE_YEAR	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 12-30-2009 / OC-2014.1	*Default Report Heading:* Cruise Year	*Relation (from Form X):* tbl_oc_cast
Purpose: Cruises are aggregated by year defined as the period December through November. For example, casts made in December 2008 and those from April 2009 are all in cruise year 2009. Casts made in October 2008 are in cruise year 2008. Cruise year is derived from DATE_GMT.		

Data type:	Varchar(4)
Maximum length:	4
Required:	yes
Measurement units:	n/a
Format:	0000
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must represent an integer between 1993 and the current year.
Optional validation rules for this attribute:	None

J.5 OC_F: NODC Repository Submission

Purpose of Deliverable

Copies of final certified detailed data are delivered to the National Oceanographic Data Center (NODC) for further dissemination. This repository is accessed by the worldwide research community to obtain detailed data. Its archive also serves as backup in case SEAN experiences a disaster.

Frequency Produced

This is generally created once per field season. In the event incorrect data ever appear in the NODC system, OC_F may be resubmitted to make it correct.

Prerequisites

Production of this deliverable is built using the certified OC_D database for a particular year, once the certified OC_M quality assessment has been applied to it.

Data Flow

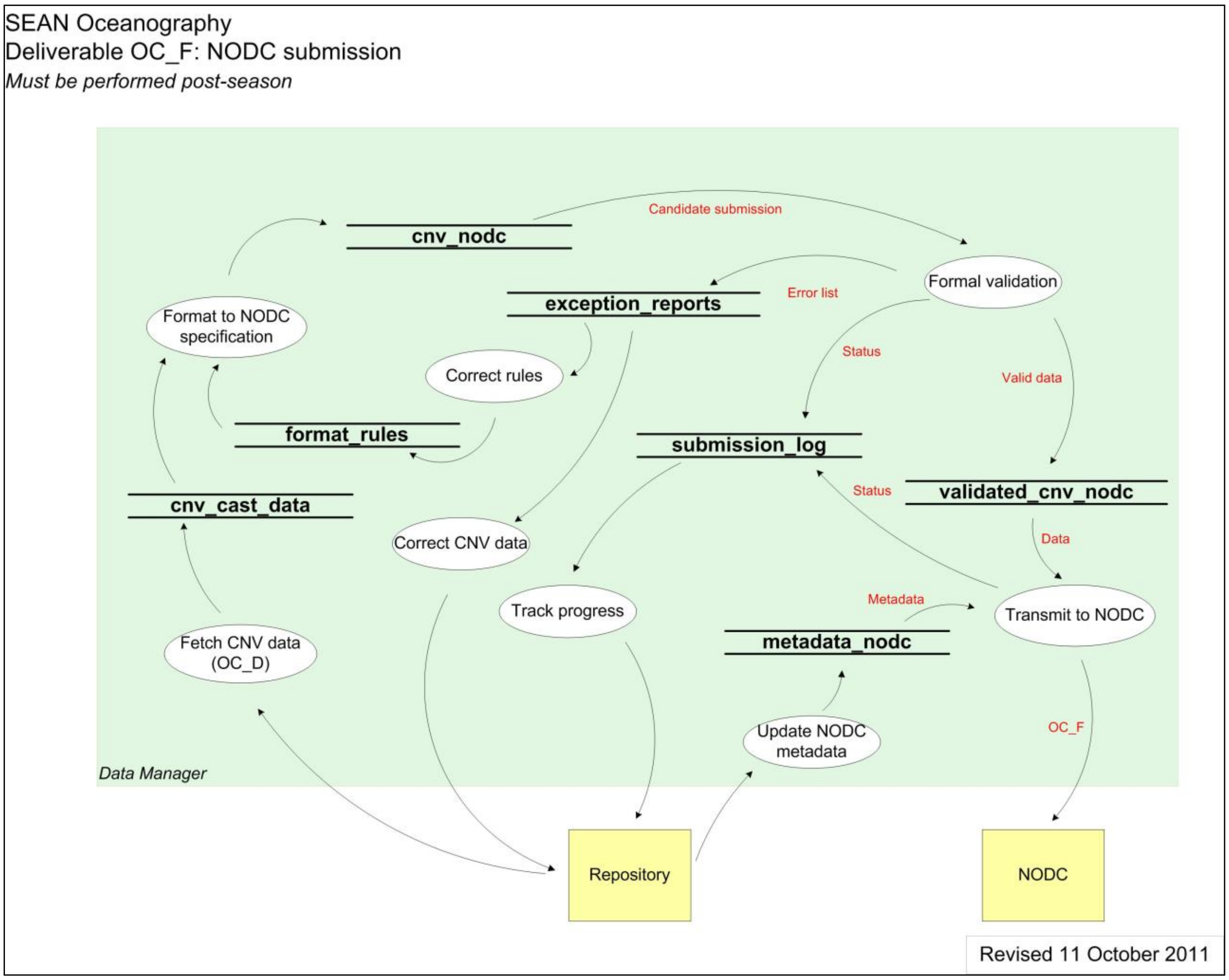


Figure J.5. Data flow required to generate deliverable OC_F: NODC submission.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

Vital Sign: OC Oceanography	*Deliverable ID:* OC_F	*Deliverable Title:* NODC submission
File format: CSV for data XML for metadata	*Associated Software and Version*: Custom for data Metavist 5.0 for metadata	*Revision Date/Protocol Version:* 01-15-2014 / OC-2014.1
Expected frequency: Once per year	*Likely dissemination partners:* NODC/NOAA	*Submission unit:* Cumulative all years in every submission
What purpose does this deliverable serve? Populates secondary repository.		
Identifiers of relations that compose the tabular deliverable ("Relations" are tables or files that provide information which may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X.): NODC_YYYY.CSV where YYYY is the most recent four-digit year represented is used to contain the detailed observations. Other files, particularly metadata documentation, may be included, depending on what NODC and SEAN mutually agree upon for each annual submission. NODC will accept almost any submission form as long as it is adequately documented.		
Deliverable ID of any other SEAN data products required to create this product: OC_D, OC_M		
Description and source of any outside data required to create this product: None		

Form X: Relation Definition

Vital Sign: OC Oceanography	*Relation Identifier:* NODC_YYYY.CSV	*Used by Deliverable ID:* OC_F
Revision Date/Protocol Version: 05-04-2009 / OC-2014.1	*Type of Relation:* Windows file	*Estimated Rows:* 370,000+

Primary key for this relation:
None

Purpose:
Oceanographic calibrated cast data binned to 1 m buckets, expressed in engineering units and provided as a comma-separated value file.

Identifiers of attributes defined over this relation (“attributes” are columns of the grid. Each attribute must be defined in an accompanying Form Y):

CTD	TEMPERATURE
DUMP	CONDUCTIVITY
CAST	SALINITY
VESSEL	SIGMA_T
STATION	FLUORESCENCE
LATITUDE	OBS
LONGITUDE	OXYGEN
DATE_GMT	PAR
TIME_GMT	SBE_DATA_FLAG
FATHOMETER_DEPTH	COMMENTS
PRESSURE	DATA_QUALITY
DEPTH	PROTOCOL_ID
	CRUISE_YEAR

Mandatory validation criteria involving multiple attributes:
None

Optional validation criteria involving multiple attributes:
None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:*	*Used by Deliverable ID:* OC_F
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:*	*Relation (from Form X):* NODC_YYYY.CSV
Purpose: All attributes used for OC_F are copies of those with the same name from OC_D. Refer to the definition of deliverable OC_D for details.		

Data type:	
Maximum length:	
Required:	
Measurement units:	
Format:	
Foreign key to (relation+attribute):	
Case:	
Mandatory validation rules for this attribute (in order of application):	
Optional validation rules for this attribute:	

J.6 OC_G: Calibration Certificate Images

Purpose of Deliverable

CTD sensors are periodically calibrated. The whole unit is generally calibrated annually, though special circumstances may cause individual sensors to be recalibrated and reported *ad hoc*. When a unit is returned to the Project Leader from calibration, it is accompanied by certificates specifying the latest calibration parameter values and attesting to their accuracy. Researchers need to find these in order to verify accurate calibration figures have been properly applied to other oceanographic data products.

Frequency Produced

Whenever the result of any sensor recalibration is reported to the Project Leader. Certificates may be provided as paper forms, which must be scanned into PDFs. They may also be supplied as PDF files on CD, which may be used directly.

Prerequisites

None.

Data Flow

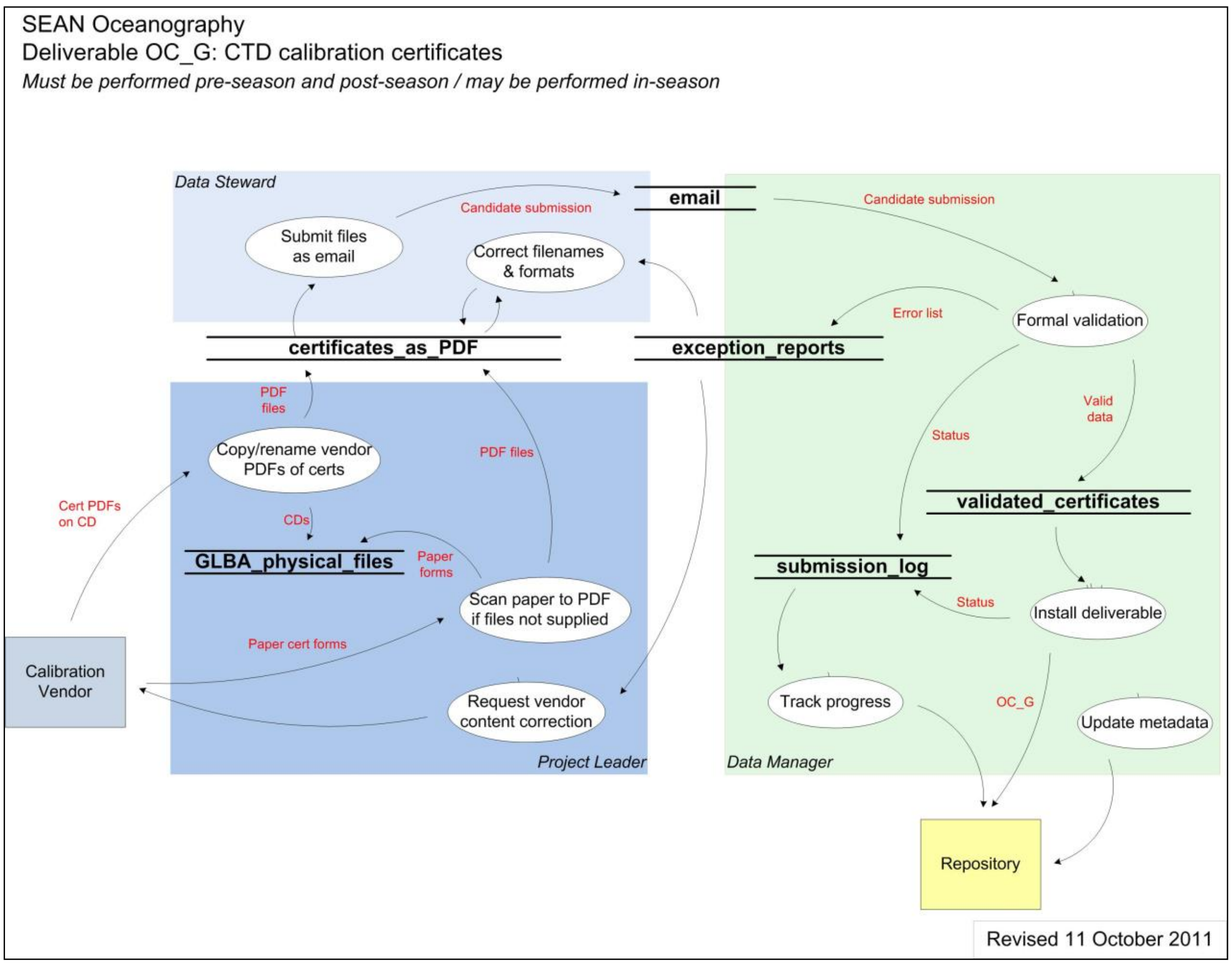


Figure J.6. Data flow required to generate deliverable OC_G: calibration certificate images.

Deliverable Definition Forms

Form C: Nontabular Data Deliverable

Vital Sign: OC Oceanography	*Deliverable ID:* OC_G	*Deliverable Title:* Calibration certificate images
File Format: PDF	*Associated Software and Version*: Adobe Acrobat 11 pro	*Revision Date/Protocol Version:* 01-15-2014 / OC-2014.1
Expected Frequency: five per CTD per year	*Likely Dissemination Partners:* None: served by SEAN	*Submission Unit:* CTD# + Sensor s/n + Year + Month
What purpose does this deliverable serve? Documents the calibration parameters for all sensors on the CTD. Needed to validate revisions to OC_A calibration CON files.		
Summary of content: Scanned images of calibration certificates saved as PDFs. Certificates are provided by CTD and sensor vendors after periodic recalibration and after obtaining new sensors.		
Mandatory validation criteria: 1. Must successfully open using Adobe Reader 11.0 or greater. 2. Filename must conform to submission unit pattern described in detailed steps in SOP 2. 3. Image must be free from artifacts that obscure valuable content.		
Optional validation criteria: None		
Deliverable ID of any other SEAN data products required to create this product: None		
Description and source of any outside data required to create this product: Paper and/or PDF calibration certificates from manufacturers.		

J.7 OC_H: Field Log Sheet Images

Purpose of Deliverable

These are scanned images of the original sampling log sheets used to record the header information for each cast of a cruise. They are made available to allow discovery and correction of erroneous header information in OC_B hex files. Notes on the images may also be viewed to explain exceptional data encountered in other products derived from OC_B. They are also required to produce OC_M quality assessment. Both front and back of each form are recorded, unless completely blank.

Frequency Produced

These should be created annually, typically after completion of the field season.

Prerequisites

Availability of the complete set of log sheets for the survey year.

Data Flow

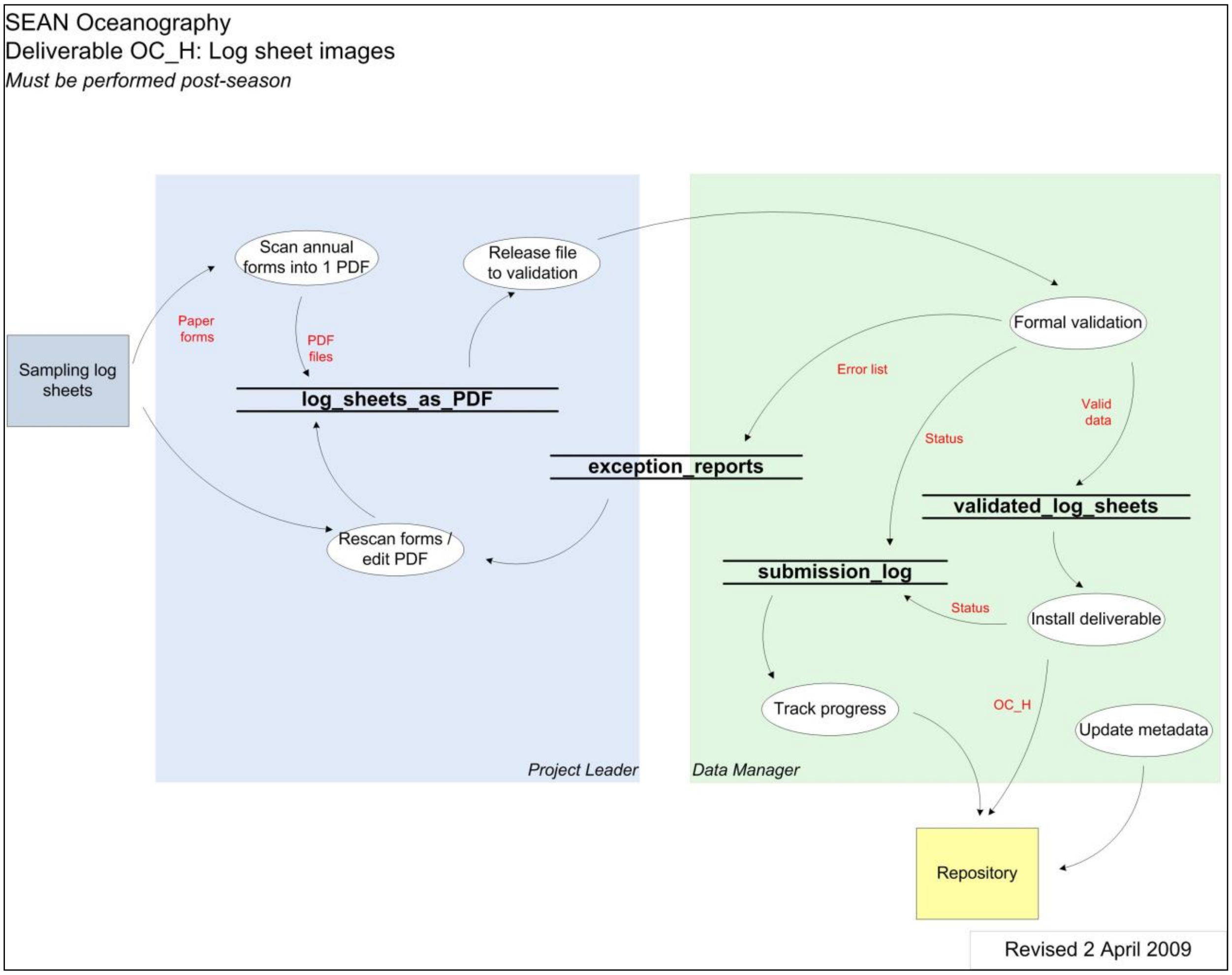


Figure J.7. Data flow required to generate deliverable OC_H: field log sheet images.

Deliverable Definition Forms

Form C: Nontabular Data Deliverable

Vital Sign: OC Oceanography	*Deliverable ID:* OC_H	*Deliverable Title:* Log sheet images
File Format: PDF	*Associated Software and Version*: Adobe Acrobat 11	*Revision Date/Protocol Version:* 01-15-2014 / OC-2014.1
Expected Frequency: 20 per year	*Likely Dissemination Partners:* None: served by SEAN	*Submission Unit:* Year
What purpose does this deliverable serve? Source documents may be used for researching data errors and individual exceptions.		
Summary of content: Scanned images of field log sheets.		
Mandatory validation criteria: 1. Must successfully open using Adobe Reader 11.0 or greater. 2. Filename must conform to submission unit pattern described in detailed steps. 3. Image must be free from artifacts that obscure valuable content.		
Optional validation criteria: 1. Should not have cast number gaps. 2. Should all be oriented properly.		
Deliverable ID of any other SEAN data products required to create this product None		
Description and source of any outside data required to create this product: Paper log sheets from field crews.		

J.8 OC_I: Protocol

Purpose of Deliverable

The protocol document defines in detail the technical methodology employed in the SEAN oceanography program.

Frequency Produced

Created as needed, using the processes in SOP 18.

Prerequisites

Protocol deliverables are always created from the most recent DOCX form of the latest OC_I protocol document.

Data Flow

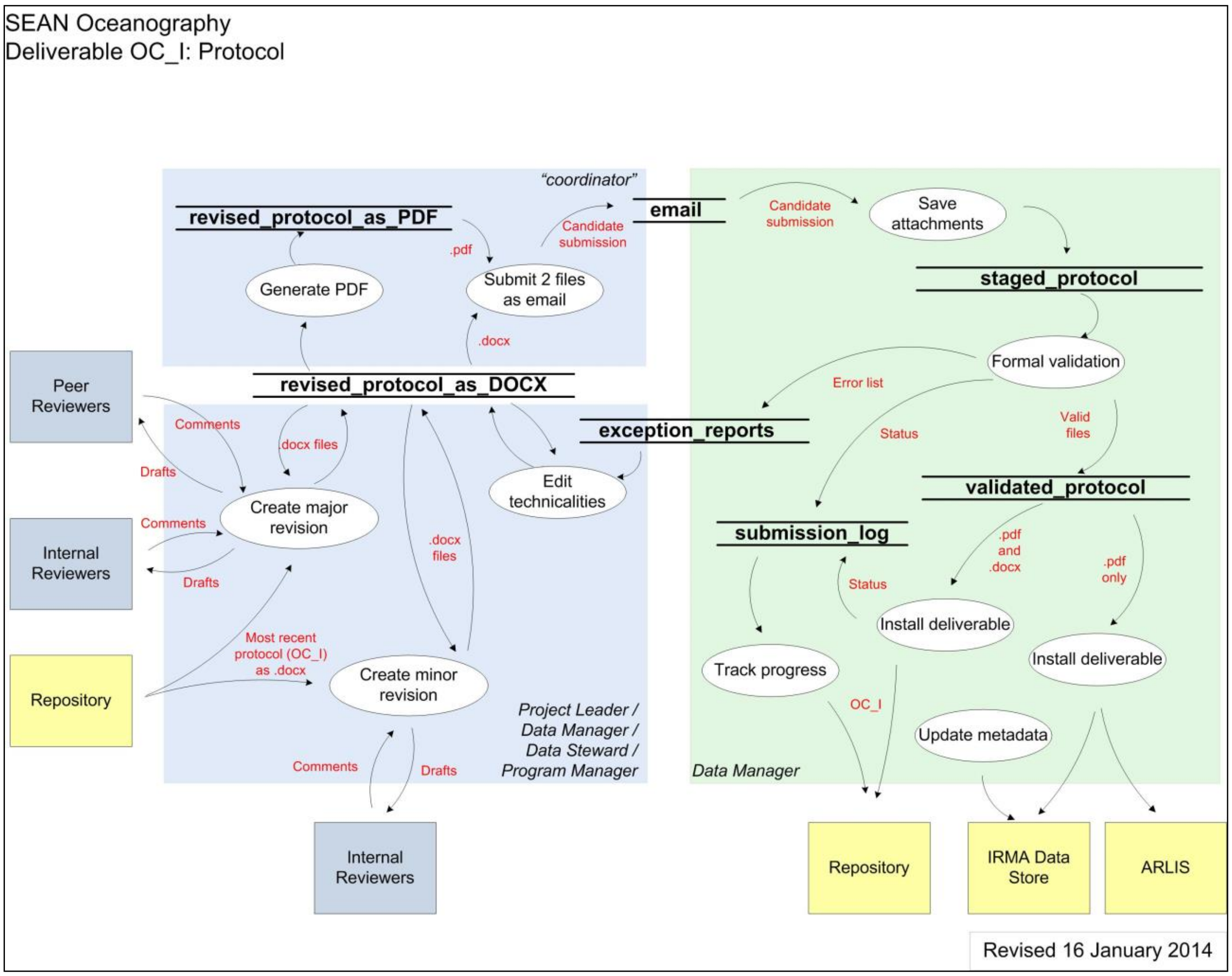


Figure J.8. Data flow required to generate deliverable OC_I: protocol.

Deliverable Definition Forms

Form A: Nontabular Information Deliverable

<table>
<tr><td>Vital Sign:
OC Oceanography</td><td>Deliverable ID:
OC_I</td><td>Deliverable Title:
Protocol</td></tr>
<tr><td>File Format:
DOCX and PDF</td><td>Associated Software and Version:
Word 2010 + Adobe Acrobat 11</td><td>Revision Date/Protocol Version:
01-15-2014 / OC-2014.1</td></tr>
<tr><td>Expected Frequency:
as needed</td><td>Likely Dissemination Partners:
None: served by SEAN</td><td>Submission Unit:
Single unit to supplant the existing OC_I.</td></tr>
<tr><td colspan="3">What purpose does this deliverable serve?
Defines the technical methodology employed in the SEAN physical oceanography monitoring program.</td></tr>
<tr><td colspan="3">Summary of content:
Narrative, detailed appendices, standard operating procedures (SOPs) for conducting program. A PDF copy is kept for dissemination purposes. A DOCX copy is kept as the basis for the next version update.</td></tr>
<tr><td colspan="3">Mandatory validation criteria:
1. PDF must successfully open using Adobe Reader 11.0 or greater.
2. DOCX must successfully open using Microsoft Word 2010.
3. Must consistently reference a correct protocol version ID, as defined in SEAN Data Management Plan (Johnson and Moynahan 2008, SOP 602: Version Control).</td></tr>
<tr><td colspan="3">Optional validation criteria:
None</td></tr>
<tr><td colspan="3">Deliverable ID of any other SEAN data products required to create this product
Prior OC_I.</td></tr>
<tr><td colspan="3">Description and source of any outside data required to create this product:
No specific sources can be named in advance. Editors will have to draw on a number of areas of technical expertise and guidance to complete this deliverable.</td></tr>
</table>

J.9 OC_J: Data Availability Matrix

Purpose of Deliverable

Researchers need to be informed of the availability of specific data by month and year. Specific data collected varies depending on factors such as the type of detectors installed at the time, weather conditions, and field circumstances. The availability depicted here is derived from the presence of entries existing in the OC_D cumulative database. If the data management procedures are strictly observed, then the matrix will inherently reflect availability of OC_D's precursors: OC_A, OC_B, OC_C, and OC_G.

Frequency Produced

This must always be performed directly after completing a deliverable OC_D cumulative database, which is normally done annually. The actual deliverable disseminated for OC_J is a PDF file. However, an Excel spreadsheet is also part of this deliverable, though not served on the website. The spreadsheet serves as the source for the PDF and the basis for the next update.

Prerequisites

OC_D cumulative database.

Data Flow

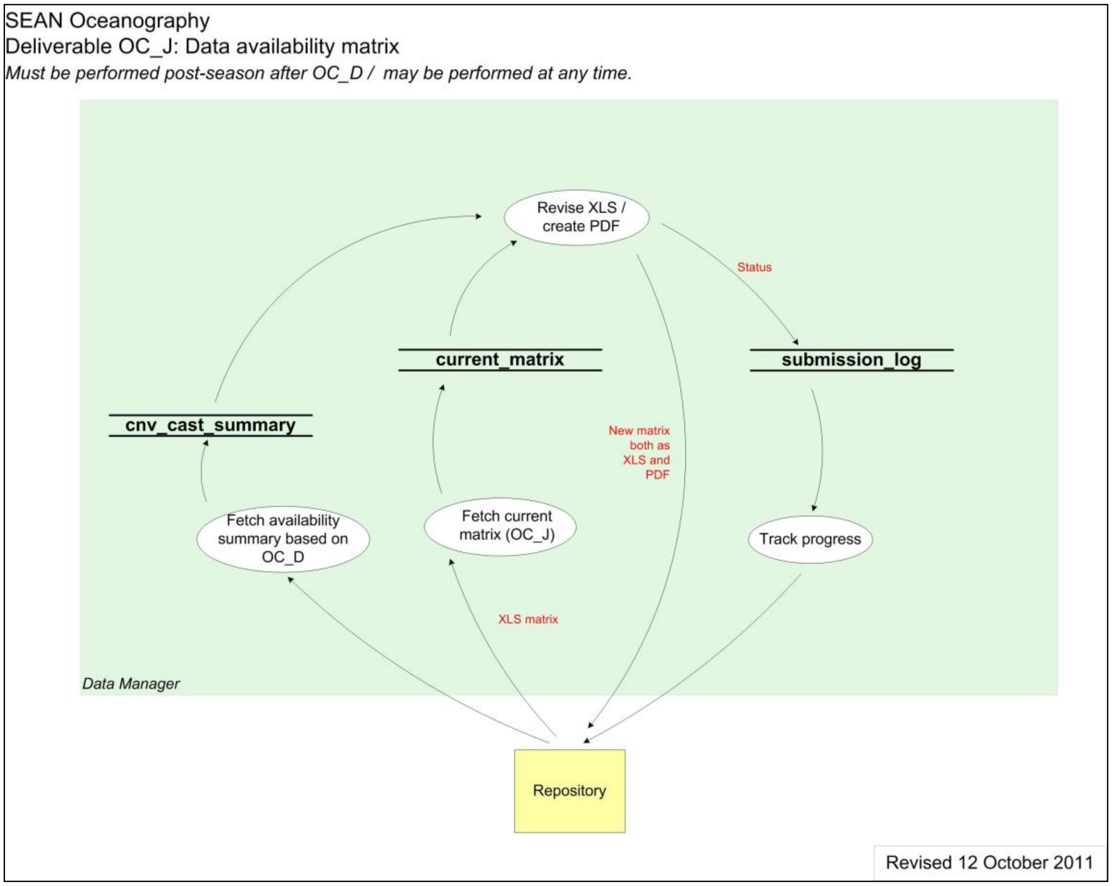


Figure J.9. Data flow required to generate deliverable OC_J: data availability matrix.

Deliverable Definition Forms

Form A: Nontabular Information Deliverable

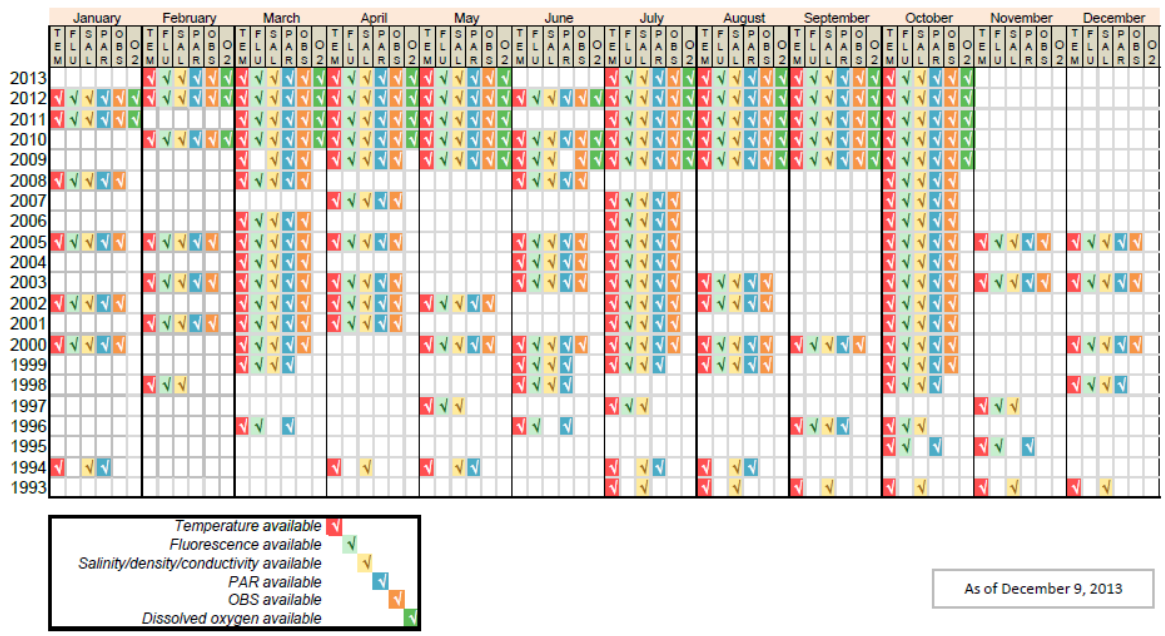
Vital Sign: OC Oceanography	*Deliverable ID:* OC_J	*Deliverable Title:* Data availability matrix
File Format: .XLSX and .PDF	*Associated Software and Version*: Excel 2010 and Adobe Acrobat 11	*Revision Date/Protocol Version:* 01-15-2013 / OC-2014.1
Expected Frequency: one per year	*Likely Dissemination Partners* None: served by SEAN	*Submission Unit:* None: is always the current state

What purpose does this deliverable serve?

Explains to customers the availability of time and type entries existing in deliverable OC_D and its precursors. Time granularity is year/month. Type granularity refers to the kind of physical parameter measured: temperature, PAR, etc.

Summary of content:

A PDF rendering of an Excel spreadsheet similar in form and content to the following:



Mandatory validation criteria:

1. Spreadsheet must be able to be opened with full functionality using Microsoft Excel 2010 or more recent version.
2. PDF must be able to be opened and properly rendered under Adobe Reader 11.0 or more recent version.

Optional validation criteria:

None

Deliverable ID of any other SEAN data products prerequisite to this product:

OC_D cumulative database.

Description and source of any outside data required to create this product:

None

J.10 OC_K: Annual Report

Purpose of Deliverable

This is a report that summarizes the operations and outcomes of a season. Content includes station coverage, tables and plots illustrating current conditions, operation exceptions, and notification of any changes to the protocol. The content is appropriate for its target audience of park management as well as the public.

Frequency Produced

These are typically created annually, after completion of each field season.

Prerequisites

Certified database deliverable OC_D for the season. Certified data quality evaluation OC_M for the season. The OC_M data quality evaluation is typically not available until after the CTD returns from annual factory calibration with new calibration factors.

Data Flow

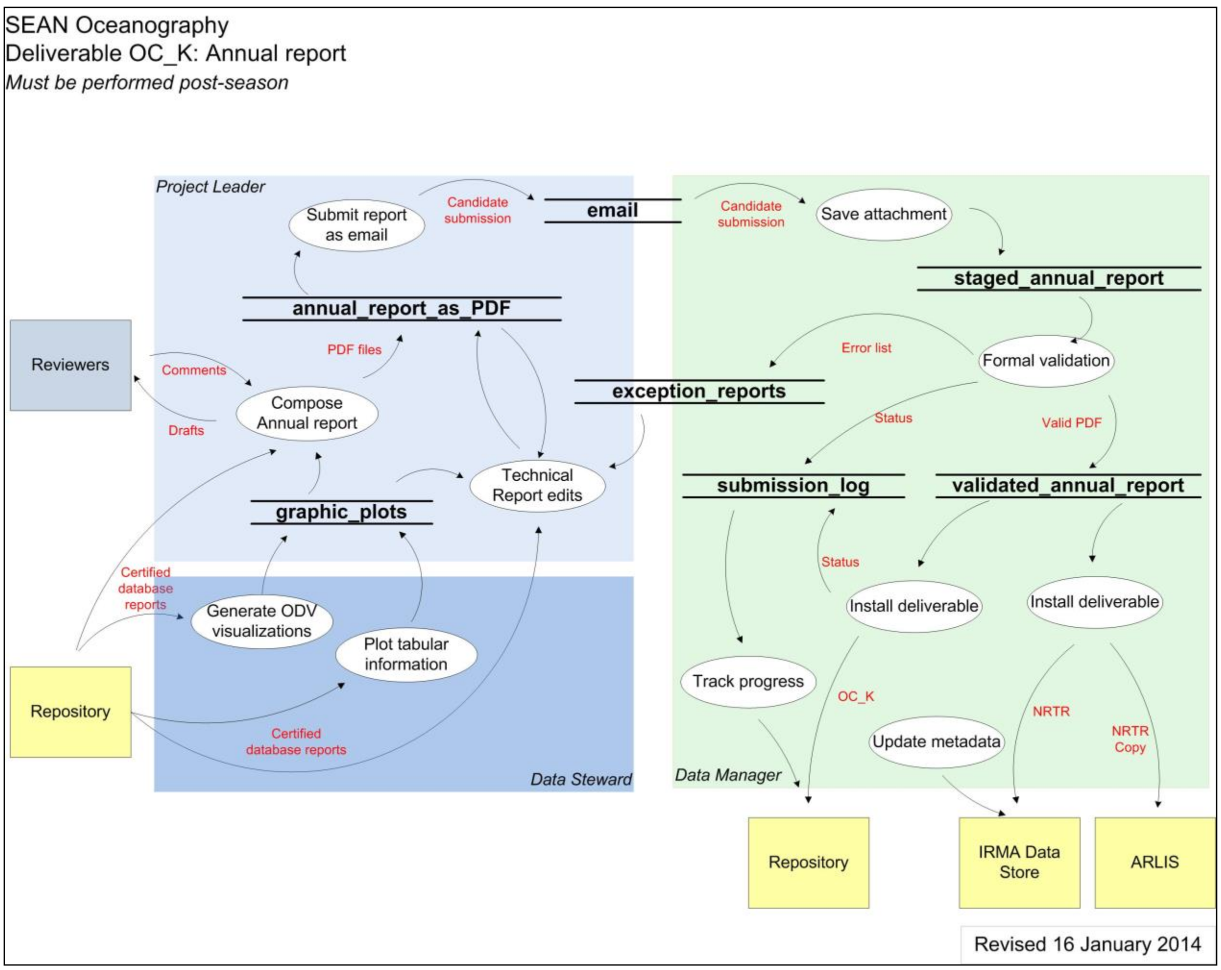


Figure J.10. Data flow required to generate deliverable OC_K: annual report.

Deliverable Definition Forms

Form A: Nontabular Information Deliverable

Vital Sign: OC Oceanography	*Deliverable ID:* OC_K	*Deliverable Title:* Annual report
File Format: PDF	*Associated Software and Version*: Adobe Acrobat 11	*Revision Date/Protocol Version:* 01-15-2014 / OC-2014.1
Expected Frequency: one per year	*Likely Dissemination Partners:* None: served by SEAN	*Submission Unit:* Year
What purpose does this deliverable serve? Summarizes the operations and outcomes of a season to inform managers, the public, and the scientific community.		
Summary of content: Synopsis of operations, temporal and spatial coverage for this season, representative data tables, representative vertical profile plots, representative data visualizations, discussion summarizing observations.		
Mandatory validation criteria: Must successfully open using Adobe Reader 11.0 or greater.		
Optional validation criteria: None		
Deliverable ID of any other SEAN data products required to create this product: OC_D CNV database rows. OC_M data quality evaluation.		
Description and source of any outside data required to create this product: None		

J.11 OC_L: Five-Year Report

Purpose of Deliverable

This report discusses trends that are evident from the historic data series. It does not cover operations, which is done in the annual report. The content is appropriate for an audience of management and the public as well as scientists.

Frequency Produced

These are created every five years, typically sometime after completion of the OC_K annual report for the most recent season.

Prerequisites

Certified database deliverable OC_D cumulative database for all seasons in the scope. Certified data quality report OC_M for all seasons in the scope.

Data Flow

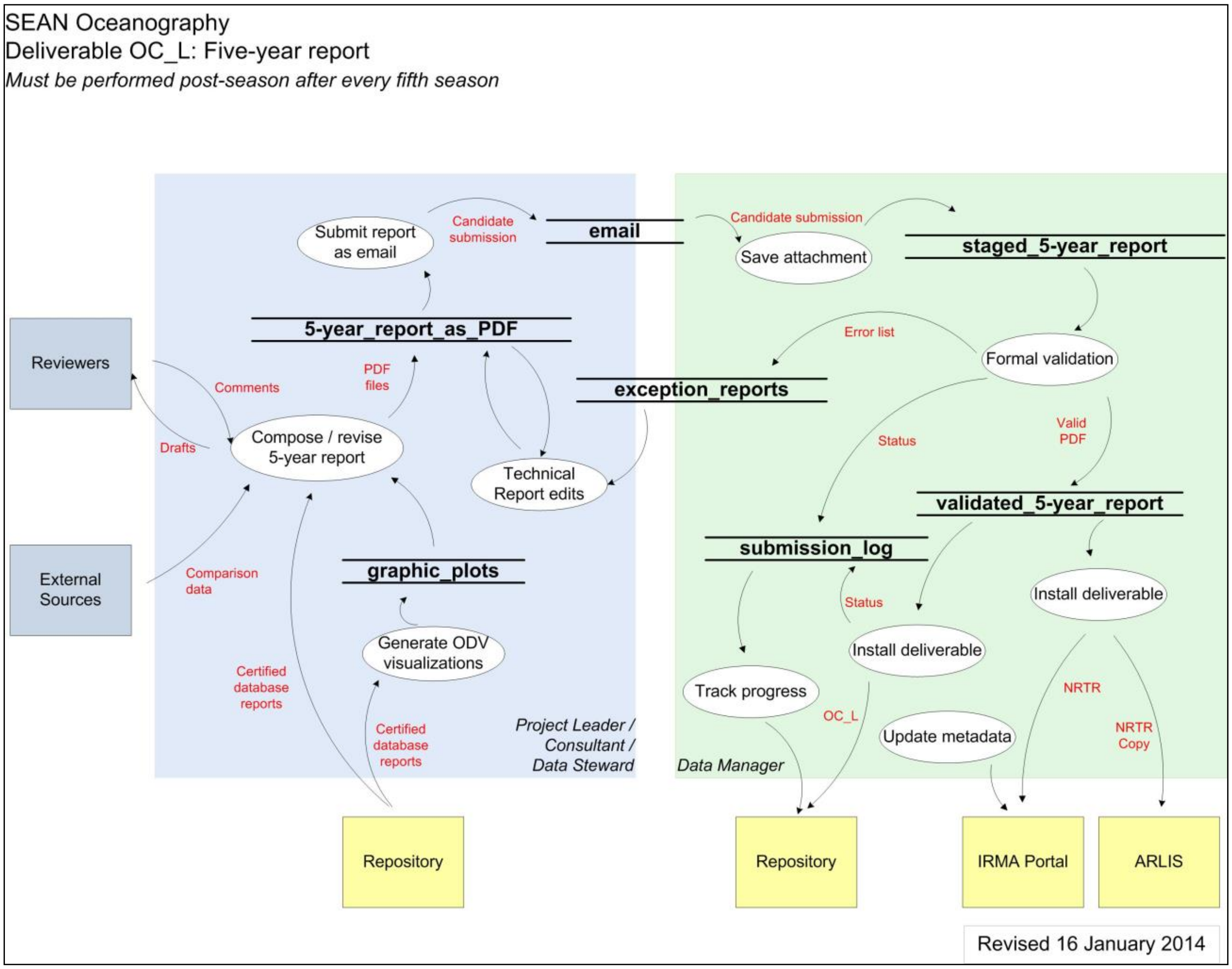


Figure J.11. Data flow required to generate deliverable OC_L: five-year report.

Deliverable Definition Forms

Form A: Nontabular Information Deliverable

<table>
<tr><td>Vital Sign:
OC Oceanography</td><td>Deliverable ID:
OC_L</td><td>Deliverable Title:
Five-year report</td></tr>
<tr><td>File Format:
PDF</td><td>Associated Software and Version:
Adobe Acrobat 11</td><td>Revision Date/Protocol Version:
01-15-2014 / OC-2014.1</td></tr>
<tr><td>Expected Frequency:
Once every five years</td><td>Likely Dissemination Partners:
None: served by SEAN</td><td>Submission Unit:
At least the most recent five-year contiguous set of survey years</td></tr>
<tr><td colspan="3">What purpose does this deliverable serve?
Analysis of physical oceanographic trends for each station is provided to inform customers and facilitate decision-making. Time series analysis for evaluating cyclic phenomena is also presented.</td></tr>
<tr><td colspan="3">Summary of content:
Introduction, methods, results, and discussion.</td></tr>
<tr><td colspan="3">Mandatory validation criteria:
1. Must successfully open using Adobe Reader 11.0 or greater.</td></tr>
<tr><td colspan="3">Optional validation criteria:
None</td></tr>
<tr><td colspan="3">Deliverable ID of any other SEAN data products required to create this product
OC_D CNV database rows and OC_M data quality evaluation for the years covered must be certified and applied before this report may be composed.</td></tr>
<tr><td colspan="3">Description and source of any outside data required to create this product:
Oceanographic time series useful for comparison include GAK1, Line P, and Ocean Station PAPA, Canadian “lighthouse, and National Data Buoy Center moorings and coastal stations. Cross correlation analysis uses climate data from NCDC and NDBC, streamflow from USGS, and large-scale climate system indices such as those available from http://jisao.washington.edu and http://www.cgd.ucar.edu/cas/catalog/climind.</td></tr>
</table>

J.12 OC_M: Data Quality Evaluation

Purpose of Deliverable

This form identifies the quality of data taken during each cast of the season. Once certified, the values in OC_M are applied to columns in the OC_D cumulative database.

Frequency Produced

OC_M is generally submitted and certified once per year. In particular, it must follow any certification of an OC_D database update.

Prerequisites

Certified database deliverable OC_D cumulative database, original *and* postseason calibration reports OC_G, field log sheets OC_H, and quality-assurance plots generated for both HEX and CNV files by Project Leader (not a deliverable).

Data Flow

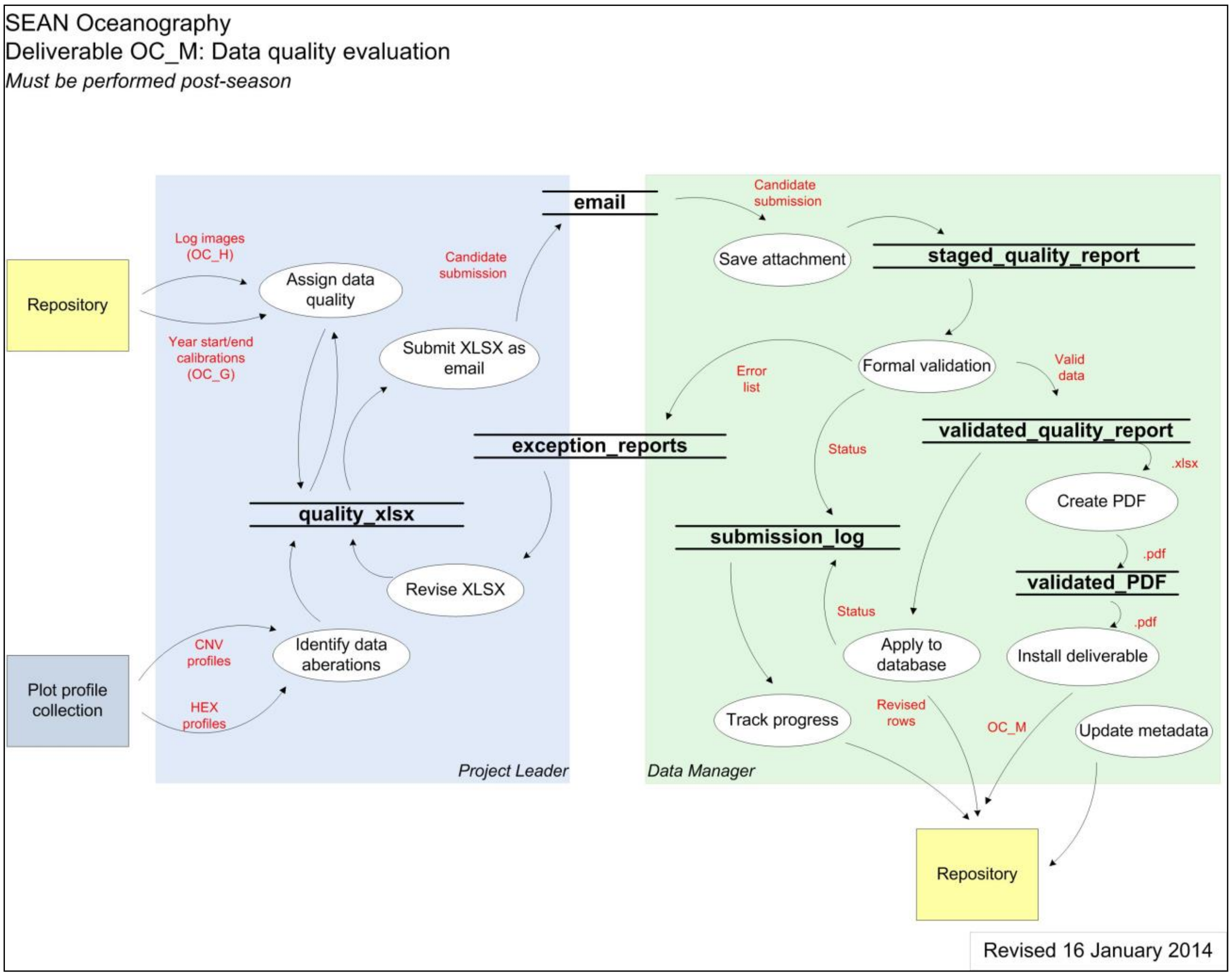


Figure J.12. Data flow required to generate deliverable OC_M: data quality evaluation.

Deliverable Definition Forms

Form D: Tabular Data Deliverable

Vital Sign: OC Oceanography	*Deliverable ID:* OC_M	*Deliverable Title:* Data quality report
File Format: XLSX workbook covering a cruise year: one tab per dump number.	*Associated Software and Version*: Excel 2010	*Revision Date/Protocol Version:* 01-15-2014/OC-2014.1
Expected Frequency: one file per year	*Likely Dissemination Partners:* None: served by SEAN	*Submission Unit:* Cruise year
What purpose does this deliverable serve? Provides data quality column values for cumulative database. When applied to the database, attribute values for the cast coming from instruments marked defective/absent are made null.		
Identifiers of relations that compose the tabular deliverable ("relations" are tables or files that provide information which may be represented in a grid format. Each relation listed must be fully defined in its own accompanying Form X): Quality_YYYY.XLSX!DDDD, where YYYY is the cruise year and DDDD is the dump number.		
Deliverable ID of any other SEAN data products required to create this product: OC_D, OC_G, OC_H		
Description and source of any outside data required to create this product: None		

Form X: Relation Definition

Vital Sign: OC Oceanography	*Relation Identifier:* Quality_YYYY.XLSX! DDDD	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Type of Relation:* File	*Estimated Rows:* 20 tabs by 25 rows

Natural key for this relation:
ctd + dump

Purpose:
Roster of casts made during a dump cycle of a particular CTD, with data quality exceptions identified.

Identifiers of attributes defined over this relation ("attributes" are columns of the grid. Each attribute must be defined in an accompanying Form Y):

CTD
DUMP
CAST
QUALITY_CODE
DATA_QUALITY_COMMENT
COND_BAD
TEMP_BAD
FLUO_BAD
OBS_BAD
PAR_BAD
O2_BAD

Mandatory validation criteria involving multiple attributes:

1. If DATA_QUALITY_COMMENT is not null, then QUALITY_CODE must not be null.

Optional validation criteria involving multiple attributes:
None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier*: CTD	*Used by Deliverable ID*: OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading*: CTD #	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: Local identification number of the CTD device (defined in Appendix F).		

Data type:	Varchar(10)
Maximum length:	1
Required:	yes
Measurement units:	n/a
Format:	9
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be between 1 and 9.
Optional validation rules for this attribute:	1. Should be between 1 and 5.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute identifier:* DUMP	*Used by deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014/ OC-2014.1	*Default report heading:* Dump#	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: The sequential dump number covered by this data.		

Data type:	Varchar(4)
Maximum length:	4
Required:	yes
Measurement units:	n/a
Format:	0009
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must represent an integer between 1 and 9999.
Optional validation rules for this attribute:	none

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* CAST	*Used by Deliverable ID:* OC_D
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* CAST#	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: Sequential cast number within a particular dump. Casts are integers beginning with zero or one, depending on CTD software level. They are generated by the CTDs themselves. Because of memory limits in some existing equipment, it is best that CAST never exceed 15.		

Data type:	Varchar(2)
Maximum length:	2
Required:	yes
Measurement units:	n/a
Format:	00
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must represent an integer between 0 and 99.
Optional validation rules for this attribute:	1. Should be between 0 and 15.

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* QUALITY_CODE	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Quality	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD

Purpose:
The numeric quality code used to flag individual casts. Codes used are those defined natively by Ocean Data View software. They are interpreted for this protocol as follows:

0: good	No exceptional circumstances were encountered; everything fell within the constraints of the protocol.
1: unknown	It is not possible to ascertain whether there were any exceptions. This typically occurs when the field log information was lost before an assessment could be made.
4: questionable	The user is alerted one or more exceptions were encountered; embedded comments should be reviewed to determine the usefulness of these data for specific purposes. Typical issues include: 1. One or two sensors providing erroneous readings 2. Short casts 3. Significant gaps in vertical profile 4. Data reconstructed from upcasts 5. Imprecise location due to failed GPS, sea ice barriers, drifting during cast, etc. 6. CTD hitting sea floor 7. Imputed values 8. Manually set bad-flags on certain readings
8: bad	Damaged to the point of not being useful: CTD not switched on, catastrophic equipment failure, three or more sensors giving erroneous readings, unknown location, CTD memory overrun, etc. Bad casts typically result in no data, so there may be no rows to tag in the OC_D database.
<null>	Until a positive action is made to assign quality, these database items have no value.

Data type:	Varchar(1)
Maximum length:	1
Required:	no
Measurement units:	n/a
Format:	9
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	1. Must be one of {0, 1, 4, 8}.
Optional validation rules for this attribute:	none

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* DATA_QUALITY_COMMENT	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Quality Comment	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: A brief explanation of why the quality was assigned. If COMMENT is entered, then QUALITY_CODE must not be null.		
Data type:	Varchar(512)	
Maximum length:	512	
Required:	no	
Measurement units:	n/a	
Format:	n/a	
Foreign key to (relation+attribute):	n/a	
Case:	n/a	
Mandatory validation rules for this attribute (in order of application):	None	
Optional validation rules for this attribute:	None	

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* COND_BAD	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Bad Conductivity	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: Set to true if the conductivity instrument has been removed from the CTD or has been judged to be giving invalid readings during this cast.		
Data type:	Boolean	
Maximum length:	1	
Required:	no	
Measurement units:	n/a	
Format:	n/a	
Foreign key to (relation+attribute):	n/a	
Case:	n/a	
Mandatory validation rules for this attribute (in order of application):	None	
Optional validation rules for this attribute:	None	

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* TEMP_BAD	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Bad Temperature	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: Set to true if the temperature instrument has been removed from the CTD or has been judged to be giving invalid readings during this cast.		

Data type:	Boolean
Maximum length:	1
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* FLUO_BAD	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.11	*Default Report Heading:* Bad Fluorescence	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: Set to true if the fluorometer has been removed from the CTD or has been judged to be giving invalid readings during this cast.		

Data type:	Boolean
Maximum length:	1
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* OBS_BAD	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Bad OBS	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: Set to true if the nepholometer has been removed from the CTD or has been judged to be giving invalid readings during this cast.		

Data type:	Boolean
Maximum length:	1
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* PAR_BAD	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Bad PAR	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: Set to true if the pyrometer has been removed from the CTD or has been judged to be giving invalid readings during this cast.		

Data type:	Boolean
Maximum length:	1
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

Form Y: Attribute Definition

Vital Sign: OC Oceanography	*Attribute Identifier:* O2_BAD	*Used by Deliverable ID:* OC_M
Revision Date/Protocol Version: 01-15-2014 / OC-2014.1	*Default Report Heading:* Bad O2	*Relation (from Form X):* Quality_YYYY.XLSX! DDDD
Purpose: Set to true if the oxygen concentration sensor has been removed from the CTD or has been judged to be giving invalid readings during this cast.		

Data type:	Boolean
Maximum length:	1
Required:	no
Measurement units:	n/a
Format:	n/a
Foreign key to (relation+attribute):	n/a
Case:	n/a
Mandatory validation rules for this attribute (in order of application):	None
Optional validation rules for this attribute:	None

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U.S. Department of the Interior

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